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INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

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BIOLOGY AND MEDICINE

4183

COBALT AS A CARCINOGEN. J. C. Heath (Strangeways Research Lab., Cambridge, England). Nature 173, 822-3 (1954) May 1.

The effect of Co (as chloride) on mitosis in chick fibroblasts, characterized by the persistence of the nucleoli in mitotic cells throughout prophase into meta-, ana-, and telaphase, is briefly discussed. With additions of Co to hanging-drop cultures after 24-hr growth, persistent nucleoli occurred in almost all dividing cells in 10 to 14 hr, but the culture begins to deteriorate after 48 hr unless tissue is transplanted. Prolonged culture life was obtained by means of the Maximow technique. Observations of giant 72-hr metaphase cells showed one or more large cytoplasmic nucleoli, mononucleate cells without division, and pyronin-staining granules. Tumor development in live rats 5 and 6 months after injection with a Co solution is discussed briefly. (J.A.G.)

4184

METABOLISM CAGE FOR SMALL ANIMALS. S. M. Hess, E. P. Laug, and O. G. Fitzhugh (U. S. Dept. of Public Health, Washington, D. C.). J. Lab. Clin. Med. 43, 824-6(1954) May.

A metabolism cage has been described and its construction specifications provided for the collection separately of feces and urine from small animals. (auth)

RADIATION EFFECTS

4185

Pittsburgh Univ. School of Medicine

STUDIES ON THE SERUM PROTEINS OF THE X-IRRADIATED RAT. Marie A. Fischer, Margaret Z. Magee, and Ellen Purvis Coulter. [May 5, 1954] 17p. Contract AT(30-1)-1077. (AECU-2877)

Total-body irradiation of the rat caused decreases in the albumin and γ-globulin areas of serum and an increase in the ratio of β_1- to β_2-globulin. Administration of the protective agent, L-cysteine, had no effect on the change in albumin and γ-globulin but it did prevent the increase of the β_1- to β_2-globulin ratio. The decrease in albumin is probably due to inanition but the change in γ-globulin is not caused primarily by the lack of food materials. Starvation caused a decrease in the α- and β-globulin areas of normal rats and since a similar decrease was not observed in x-irradiated-starved animals, it was concluded that the α- and β-globulin fractions of the sera of irradiated rats are present in abnormal quantities even though their electrophoretic areas fall into the range for normal, untreated animals. (auth)

4186

Utah Univ. Coll. of Medicine

A STUDY OF THE IRRADIATION SYNDROME. PART 1. WATER, ELECTROLYTE AND NITROGEN BALANCES. Roy E. McDonald, Ross E. Jensen, Herbert C. Urry, Vern S. Bolin, and Philip B. Price. [1953?] 23p. Contract AT(11-1)-82. (AECU-2882)

Data are reported from a study of the effects of acute total-body irradiation upon water, electrolyte, and N balances in dogs in which typical hemorrhagic syndromes had been produced. (C.H.)

4187

Food Research Inst.

A. STUDY ON THE EFFECT OF RADIATION ON HEAT RESISTANCE OF BACTERIAL SPORES. H. Sugiyama. B. STUDY OF THE EFFECT OF RADIATION ON STAPHYLOCOCCUS ENTEROTOXIN. M. J. Surgalla. C. RADIATION STUDIES ON CHEESE SPREADS. R. O. Wagenaar. REPORT NO. 3 COVERING PERIOD JULY 1, 1953–MARCH 31, 1954. 20p. Contract AT(11-1)-231. (AECU-2901)

Partially purified Staphylococcal enterotoxin was irradiated at three different dosage levels and assayed by monkey feeding tests. Enterotoxin was inactivated at a dosage of 1,800,000 rep, but not at 160,000 or 460,000 rep. Data are presented from 14 experiments on soft surface-ripened cheese samples inoculated with Clostridium botulinum spores and irradiated at various dosages of γ radiation from a Co^{60} source. The spores were inactivated at dosages varying from 550,000 to 1,100,000 rep, and the toxin producing ability of the spores was unaltered by sub-lethal dosages. (C.H.)

4188

Naval Medical Research Inst., Bethesda

MORPHOLOGIC EFFECTS OF IRRADIATION OF THE SALIVARY GLANDS OF RATS. James A. English. Feb. 1, 1954. 12p. (NM-006-012.04.66)

Salivary glands of rats were examined 16 hours to 100 days following application of 200 kvp x rays in doses of 1000 and 1500 r. A total of 162 rats were involved, 72 of them being used as litter-mate controls. Sufficient morphologic changes were observed in submaxillary salivary glands of animals sacrificed beyond the 15-day period to permit accurate separation of unmarked control and irradiated tissues. The changes consisted primarily of alteration in size, shape, and staining characteristics of nuclei of acinar cells. Changes were observed in other salivary glands, but were not characteristic enough to serve as invariable means of identification. A detailed description of the normal salivary glands of rats is given. (auth)

4189

School of Aviation Medicine

BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. EFFECTS OF WHOLE-BODY X-RADIATION IN GUINEA PIGS WHILE UNDER VARIOUS SIMULATED FLYING CONDITIONS. REPORT NO. 11. Eugene B. Konecci and William F. Taylor. Apr. 1954. 12p. (NP-5179)

Flying conditions were simulated using a special plastic low-pressure chamber. Two hundred fifty male guinea pigs, averaging 300 g in weight, were utilized in 17 different treatments. Total-body exposures were given with a dose rate of 145 r per minute of 260 kvp and 18 ma of x radiation. Severe hypoxia greatly increased survival time over ground-level controls in all dose levels tested (i.e., 500, 1600, 4000, and 8000 r). No increase in radiosensitivity resulted from breathing 100 per cent oxygen. Cold alone slightly increased survival time, but cold at altitude with 100 per cent oxygen

showed no such protection. Cold plus severe hypoxia markedly increased survival time. Nondigestible diet (asbestos fiber) and long flight both significantly increased survival times. Results indicated that the general conditions met while flying were not detrimental to the guinea pig in combination with exposure to ionizing radiation. (auth)

4190

Atomic Energy Project, Western Reserve Univ. QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1954. Hymer L. Friedell. 8p. Contract [W-31-109-eng-78] (NYO-4960)

Data are presented from studies of the effect of cysteine on blood oxygenation; determinations of blood and tissue sulfhydryl levels in the rat; the construction of scintillation counters and counting apparatus for use in clinical tracer studies; the incorporation of P^{32} into the acid-soluble tissue fractions in normal and irradiated rats; and the effects of injections of bone marrow on radiation injuries. (C.H.)

4191

THYROGLOBULIN IN SERUM AFTER I^{131} THERAPY. I. SALTING OUT. Jacob Robbins (Memorial Center for Cancer and Allied Diseases, New York). J. Biol. Chem. 208, 377-86(1954) May. (cf. NSA 8-63).

Serum I^{131} was studied by salting out the serum proteins with equimolecular KH_2PO_4 and K_2HPO_4 at pH 6.5. Data are presented which suggest that destruction of thyroid tissue with radioiodine may release unchanged thyroglobulin into the circulation. (C.H.)

4192

CHANGES IN CLOT RETRACTION TIME AND PLATELET ADHESIVENESS FOLLOWING WHOLE BODY IRRADIATION. J. Philip Savitsky and Sol Sherry (May Inst. for Medical Research, Cincinnati, Ohio). Proc. Soc. Exptl. Biol. Med. 85, 587-90(1954) Apr.

Inhibition of platelet adhesiveness and a prolongation of clot retraction time was observed in the blood of dogs three days after exposure to whole-body radiation. Inhibition of clot retraction time was reversed in vitro by addition of excess of Ca. This suggests a defect in the irradiated animal in the use of Ca in initiation of clot retraction. A plasma factor, which decreased platelet adhesiveness and inhibited clot retraction, was demonstrated eight days post-irradiation, and was most pronounced during thrombocytopenia. (C.H.)

4193

EFFECT OF DIET AND TRACE MINERALS ON ERYTHROCYTE FRAGILITY AND X-IRRADIATION MORTALITY IN RATS. Marguerite A. Constant and Paul H. Phillips (Univ. of Wisconsin, Madison). Proc. Soc. Exptl. Biol. Med. 85, 678-82(1954) Apr.

The data indicate that the fragility of erythrocytes pre-irradiation was of less importance in determining the lethality of irradiation for rats than the type and adequacy of the diet. The three basal diets used in these studies supported growth equally well; however, animals fed diet 1 (natural) succumbed to the effects of irradiation more rapidly than did animals fed diet 2 (natural) (rbc's equally fragile) or those fed diet 3 (synthetic) (rbc's less fragile). Dietary trace mineral supplementation was observed to reduce the erythrocyte fragility. This effect which was traced to the cobalt of the supplement was pronounced and was associated with the feeding of one of the natural diets (diet 2). Although the rbc's of animals fed the supplemented diet 2 were less fragile, these animals showed an earlier and more rapid mortality rate than did animals fed the basal diet. The data from the present studies indicate that long term feeding of polycythemic levels of cobalt increased the mortality rate of animals given whole body irradiation. (auth)

4194

PROLONGATION OF THE LAG PHASE OF IRRADIATED ESCHERICHIA COLI. E. Beutler, Melba J. Robson, and L. O. Jacobson (Univ. of Chicago, Ill.). Proc. Soc. Exptl. Biol. Med. 85, 682-5(1954) Apr.

A prolongation of the lag phase in irradiated E. coli is described. The modifying effects of temperature during growth, storage of irradiated organisms, and the addition of mouse blood, inactivated rabbit serum, 0.5% cysteine solution, the filtrate of actively growing E. coli cultures, fresh spleen, liver and kidney mash, or growing non-irradiated E. coli cultures, have been studied. Evidence that sublethal effects of x irradiation in bacteria differ from lethal effects is discussed. (auth)

4195

DEUTERON INACTIVATION OF DRY BOVINE SERUM ALBUMIN. W. P. McNulty, Jr. and Franklin Hutchinson (Yale Univ., New Haven, Conn.). Arch. Biochem. and Biophys. 50, 92-103(1954) May.

The inactivation with deuterons of bovine serum albumin, as assayed by its ability to combine specifically with its homologous rabbit antiserum, is logarithmic when the samples are dissolved in phosphate buffer, indicating that the passage through the molecule of a single deuteron is capable of inactivating it. If the irradiated samples are dissolved in distilled water, a more rapid inactivation with dose is observed, and the inactivation curve has a possible multiple-hit character. The inactivation is shown to be the result of the molecule being made insoluble by the action of the radiation. The dependence of the inactivation with deuterons of various rates of energy loss is measured. It is shown that the results are consistent with either of two assumptions: that only about one-third of the primary ionizations cause permanent damage, or that several ionizations from the same charged particle are needed to inactivate one molecule. This is in marked contrast to results reported in the literature for various other dried proteins. The inactivation is greatly reduced by cooling the sample to liquid-air temperature during irradiation. (auth)

4196

EFFECT OF X-RAYS ON THE PERMEABILITY AND BARRIER FUNCTIONS OF SUBCUTANEOUS CONNECTIVE TISSUE AND LYMPHATIC NODES. P. N. Kiselev (Ministry of Health, U.S.S.R.) Vestnik Rentgenol. i Radiol., No. 6, 8-14 (1953) Nov.-Dec. (In Russian)

Experimental data obtained by irradiating animals (mice) and then infecting them show that therapeutic doses of x rays affect the permeability and barrier functions of lymphatic nodes in the same manner as those of the skin or connective tissue. The barrier action of the nodes, which is originally reduced by irradiation, returns to normal and then is increased due to reduced permeability. Doses higher than 300 r damage lymphatic nodes permanently and do not increase their barrier action. Nonspecific resistance of the organism and/or tissues is increased similarly by ultraviolet rays, Bezredka's antivirus, and other agents. (J.S.R.)

4197

EFFECTS OF ANEURIN (VITAMIN B_1) ON THE GLYCOGEN FORMATION FUNCTION OF LIVER OF RATS DURING GENERAL EXPOSURE TO VARIOUS DOSES OF X-RAYS. B. M. Graevskaya, R. Ya. Keylina, and S. E. Manoylov (Ministry of Health, U.S.S.R.). Vestnik Rentgenol. i Radiol., No. 6, 22-5(1953) Nov.-Dec. (In Russian)

Experiments conducted on 15 rats showed that the glycogen formation function of the liver may be partially restored

if vitamin B_1 is given after rats have been exposed to x rays. Enough evidence was collected to justify the assumption that the quality of biochemical changes in the organism of rats depends upon the extent of exposure to x rays: small doses (500 r) of x rays suppress the oxidation systems of the whole organism; larger doses (1,000 and 2,000 r) also cause breakdown of the substances that oxidize. It is possible that interference with the synthesis of the dehydrogenase coenzyme takes place and that vitamin B_1 loses its capacity to combine with phosphoric acid. This follows from a reduction of the restorative effect of vitamin B_1 on the liver. (J.S.R.)

RADIATION HAZARDS AND PROTECTION

4198

American Cyanamid Co., Atomic Energy Div., Idaho Falls, Idaho

CPP HEALTH PHYSICS MANUAL. Apr. 1952. 142p. Contract [AT-(10-1)-205]. (IDO-14055; ACCO-2649)

4199

THE EFFECTS OF TESTOSTERONE PROPIONATE AND TESTOSTERONE CYCLOPENTYLPROPIONATE UPON MORBIDITY AND MORTALITY IN MICE FOLLOWING LETHAL TOTAL-BODY IRRADIATION. Mitchell W. Spellman, James C. Carlson, and C. Walton Lillehei (Univ. of Minnesota, Minneapolis). Cancer 7, 617-21(1954) May.

Testosterone propionate, in the dose employed, enhanced morbidity (as reflected by weight loss) and failed to confer protection against the lethal effects of total-body irradiation in mice. The quantity of the dose, the frequency of administration, local reactions at the sites of injection, and the intense androgenic response to testosterone propionate may be factors that influence this increased susceptibility to irradiation mortality and morbidity. In contradistinction, the long-acting testosterone cyclopentylpropionate, when injected once every fourteen days with or without pretreatment, significantly reduced the mortality and the morbidity following lethal doses of total-body irradiation. The beneficial effects of testosterone cyclopentylpropionate in diminishing mortality and morbidity following total-body irradiation in mice are presumed to be the result of its anabolic action. (auth)

4200

THE ROLE OF HIGH IONIC CONCENTRATIONS IN PROTECTION AGAINST X-IRRADIATION. C. S. Bachofer and M. Aelred Pottinger (Univ. of Notre Dame, Ind.). J. Gen. Physiol. 37, 663-75(1954) May 20.

Various levels of protection against x radiation injury in bacteriophage were achieved by the addition of inorganic salts to the aqueous virus suspensions during irradiation. The highest survival values were obtained with the nitrite salts, and their protective effect was attributed to their function as a reducing agent. Data are included on the protective effects afforded by various concentrations of nitrate ions, sulfate ions, chloride ions, ammonium salts, metallic salts, and by variations in pH. (C.H.)

4201

ON THE RADIOSENSITIVITY OF THE ADULT RAT IN HYPOTHERMY. François Baclesse and Maurice Marois. Compt. rend. 238, 1926-8(1954) May 10. (In French)

The hypothermy caused by the administration of 3-chloro-10(3-dimethylaminopropyl)-phenothiazine (I) and refrigeration increases the resistance to x rays of the adult male rat. This modification is not caused by (I) but by the lowering of the body temperature. (tr-auth)

RADIOTHERAPY

4202

TREATMENT WITH RADIOACTIVE COBALT Co^{60} OF CANCER OF THE CERVIX OF THE UTERUS. A. A. Stankevich (Academy of Science, U.S.S.R.). Vestnik Rentgenol. i Radiol., No. 6, 64-6(1953) Nov.-Dec. (In Russian)

The availability of the new radioactive isotope Co^{60} and its successful use in teleradiation therapy induced investigation of the use of this isotope for treatment of cancer of the cervix of the uterus. Experiments on rats showed that injury to tissues caused by Co^{60} is less than that produced by radon or radium-mesothorium. Treatment of patients with Co^{60} yielded good results and did not produce any harmful effects. (J.S.R.)

TOXICOLOGY STUDIES

4203

STUDIES IN VANADIUM TOXICOLOGY. II. DISTRIBUTION AND EXCRETION OF VANADIUM IN ANIMALS. N. A. Talvitie and W. D. Wagner (Dept. of Health, Education, and Welfare, Cincinnati, Ohio). Arch. Ind. Hyg. and Occupational Med. 9, 414-22(1954) May.

From a study of rats and rabbits injected intraperitoneally and intravenously, respectively, with a soluble pentavalent V salt in doses producing minimal or no histologic changes in the kidneys and with no observed effect on the intestine, it was shown: the kidneys are the major route of excretion, the V being apportioned in the ratio of 5 to 1 between the urine and the feces; renal excretion is rapid, 61% being eliminated within the first 24 hours following dosage; the percentage of excreted V is essentially independent of the number of doses administered; renal V values rapidly reflect changes in dosage; the amount of intestinal excretion amounts to 10 to 12% of the total dose, the remainder being retained in approximately equal quantity in the body for a period of at least two weeks; most of the retained V resides in the skeleton, although small concentrations are to be found in all tissues analyzed; and blood V levels are measurable spectrographically for at least six hours after exposure. (auth)

4204

STUDIES ON THE MECHANISM OF PROTECTION BY AURINTRICARBOXYLIC ACID IN BERYLLIUM POISONING. II. EQUILIBRIA INVOLVING ALKALINE PHOSPHATASE. Jack Schubert and Arthur Lindenbaum (Argonne National Lab., Lemont, Ill.). J. Biol. Chem. 208, 359-68(1954) May. (cf. NSA 6-1615).

The interactions of beryllium, aurintricarboxylic acid (ATA), salicylic acid (SA), and sulfosalicylic acid (SSA) with plasma alkaline phosphatase were studied. The reactions have been formulated on a quantitative basis from simple mass action considerations, and formation quotients have been calculated. The results have been interpreted in relation to the protection offered by ATA, SA, and SSA in the treatment of acute experimental beryllium poisoning. The greater effectiveness of ATA compared to the other compounds is ascribed to two principal causes: it forms a much stronger chelate and is bound far more strongly to protein. The enzymatic method for the measurement of the stability of complex ions is discussed. (auth)

TRACER APPLICATIONS

4205

RELATIVE RATES OF BIOLOGICAL DECAY OF THYROIDAL I^{131} IN RAT AND GUINEA PIG. Catherine E. Stevens and S. A. D'Angelo (Jefferson Medical Coll.,

Philadelphia.). Proc. Soc. Exptl. Biol. Med. 85, 633-5 (1954) Apr.

The rate of biological decay of thyroidal I^{131} was compared in rat and guinea pig by determining the reduction in radioactivity over the gland utilizing the in vivo detection technique. The biological half life of radioiodine was estimated to be 3.5 and 26 days for the rat and guinea pig respectively. The results are considered to suggest that thyroid hormone secretion in the guinea pig normally proceeds at a much slower rate than in the rat. Consideration of other parameters of pituitary-thyroid function for both species supports this view. (auth)

4206

ION EXCHANGE AND RECRYSTALLIZATION IN FIXATION OF Ca^{45} IN THE RABBIT'S SKELETON. J. S. Arnold and W. S. S. Jee (Univ. of Utah, Salt Lake City). Proc. Soc. Exptl. Biol. Med. 85, 658-63(1954) Apr.

Undecalcified bone sections of rabbits sacrificed at intervals between one hour and 3 weeks following Ca^{45} administration were treated in calcium acetate solutions. This procedure was designed to determine what portion of Ca^{45} remains on crystal surface of bone as a function of time following administration. The data are interpreted as indicating that recrystallization and crystallization processes are removing calcium to non-exchangeable positions at extremely rapid rates. At one hour following Ca^{45} administration, $\frac{1}{2}$ of the isotope fixed in bone is no longer available to removal by ion exchange technic. (auth)

4207

METABOLISM OF HYDROGEN ISOTOPES BY RAPIDLY GROWING CHLORELLA PYRENOIDOSA CELLS. Daniel Weinberger and John W. Porter (General Electric Company, Richland, Washington). Arch. Biochem. and Biophys. 50, 160-8(1954) May.

Chlorella pyrenoidosa cells have been grown in the presence of deuterium and tritium oxide, and the quantity of each of these isotopes incorporated into the whole cells, methanol-insoluble, ether-soluble, and methanol-soluble, ether-insoluble fractions has been determined. The quantity present has been recorded in terms of the per cent expected on the assumption of no isotope effect. It has been found that the cells incorporate deuterium approximately 50% as rapidly as hydrogen, and that they incorporate tritium 90% as rapidly as deuterium. Further, the extent of incorporation of tritium or deuterium by the enzymes involved in hydrogen transfer in the synthesis of lipides is significantly higher than the extent of incorporation by enzymes involved in the transfer of hydrogen in the synthesis of proteins, nucleic acids, and starch (methanol-insoluble fraction). (auth)

4208

CLINICAL INVESTIGATIONS ON THE USE OF RADIOACTIVE GALLIUM (Ga^{66} AND Ga^{67}) IN BONE DISEASES. J. Th. van der Werff. Acta Radiol. 41, 343-7(1954) Apr.

The author attempted to confirm the findings of American authors (Dudley and co-workers) that radioactive gallium selectively concentrates in bone tumours to such a degree that its therapeutic exhibition would be warranted. Employing Ga^{66} and Ga^{67} instead of the Ga^{72} used by these authors, some differences between the concentrations in pathologic and normal bone were noted, but not to the extent reported. The value of the general use of radioactive gallium as a therapeutic agent for bone tumours must be considered doubtful. (auth)

CHEMISTRY

4209

Oregon Univ.

STUDIES ON THE ANODIC POLARIZATION OF ZIRCONIUM AND ZIRCONIUM ALLOYS. Mario Maraghini, George B. Adams, Jr., and Pierre Van Rysselberghe. Sept. 1953. 61p. Contract AT(45-1)-535. (AECU-2797)

The anodic polarization of zirconium and of some of its alloys was studied in several different aqueous electrolytes. In chloride solutions, corrosion potentials below that of oxygen evolution were established, but the addition of nitrate ion in the ratio of 3 to 5 to chloride ion brings the potential above that of oxygen evolution. The formation of the oxide film along the three portions of the potential-time curve (initial rapid increase, evolution of oxygen at practically constant potential, final rapid increase) was studied in detail, and quantitative information about local currents and the efficiency of the film-building process was obtained. (auth)

4210

Institute of Science and Tech., Univ. of Ark.

PROGRESS REPORT FOR THE PERIOD JANUARY 1, 1953 THROUGH MARCH 31, 1953. W. J. Smothers. Apr. 20, 1953. 13p. Contract W-7405-eng-26, Subcontract 501. (AECU-2872)

Preliminary results are reported in studies of the hydrogen pressure resulting from the NaOH + Ni reaction, corrosion of Ni by molten NaOH, solubility studies of nickel oxide in molten NaOH, and the thermal potential of nickel in $NiCl_2$ solutions. Reaction vessels and apparatus used for the measurement of thermopotentials are described. (C.H.)

4211

Institute of Science and Tech., Univ. of Ark.

PROGRESS REPORT FOR THE PERIOD APRIL 1, 1953 THROUGH JUNE 30, 1953. W. J. Smothers. July 30, 1953. 17p. Contract W-7405-eng-26, Subcontract 501. (AECU-2873)

Results are reported in studies of hydrogen pressure resulting from the reaction of Ni and NaOH, thermal analysis of NaOH-$Ba(OH)_2$ systems, and the solubility of nickel oxide and UO_3 in NaOH. Equipment used in the studies is described. (For preceding period see AECU-2872.) (C.H.)

4212

Utah Univ.

A KINETIC STUDY OF THE OXIDATION OF SPHALERITE. John N. Ong, Jr., Milton E. Wadsworth, and W. Martin Fassell, Jr. Mar. 29, 1954. 17p. Contract AT(11-1)-82, Technical Report No. 10. (AECU-2881)

Oxidation of sphalerite was found to be linear over the range 700 to 830°C with an activation energy of 63.4 kcal/mole. Oxygen concentration-rate studies revealed primary Langmuir adsorption of oxygen prior to thermal decomposition. A reaction mechanism was proposed for the overall reaction $2\ ZnS + 3O_2 \rightarrow 2\ ZnO + 2SO_2$ involving single-site adsorption of oxygen on sphalerite. On this basis, excellent agreement was obtained between the experimental results and theoretical calculations. The enthalpy of adsorption of oxygen on the surface of the sphalerite was found to be −59.6 kcal/mole. Data are presented which indicate conditions under which either a sulfatizing or an oxidizing roast may be obtained. (auth)

4213

California Research Corp.

DEVELOPMENT OF HIGH-TEMPERATURE AIRCRAFT HYDRAULIC FLUIDS. Neil W. Furby. Sept. 1953. 81p. Contract AF-33(038)-9831. (AF-TR-6685(suppl.2))

4214
Carbide and Carbon Chemicals Co. (K-25)
THE MOLAR POLARIZATION, DIPOLE MOMENT, AND NONIDEALITY OF TRICHLOROHEPTAFLUOROBUTANE VAPOR. D. W. Magnuson. May 25, 1954. 7p. Contract W-7405-eng-26. (K-1130)

The molar polarization, dipole moment, and nonideality of trichloroheptafluorobutane vapor was determined using a microwave dielectric constant technique. (auth)

4215
Texas Univ.
THE ELECTROCHEMICAL POLARIZATION OF ZIRCONIUM IN DISTILLED WATER. Norman Hackerman and Otto L. Willbanks, Jr. Apr. 23., 1954. 27p. Contract Nonr-375 (02). (NP-5151)

The cathodic polarization curve for zirconium in air-saturated distilled water at 40°C was determined in the current-density range 3.0×10^{-7} to 1.0×10^{-3} amp/cm^2. At low current densities the reaction was the reduction of dissolved molecular oxygen to hydroxyl ions, its limiting diffusion current being about 5×10^{-6} amp/cm^2. The formation of a zirconium hydride film was the reaction proposed to explain a plateau in the curve which had a constant potential of −0.30 v vs. standard calomel electrode and a limiting current of 1.0×10^{-4} amp/cm^2. X-ray diffraction data, time-potential curves, observations, and other evidences substantiated this possibility. Above 1.0×10^{-4} amp/cm^2 hydrogen evolution occurred, and the curve followed a Tafel relationship, the slope being −0.14 v. The hydrogen overvoltage at 1.0 ma/cm^2 was 0.75 v. The open-circuit potential of zirconium in air-saturated distilled water at 40°C was determined to be + 0.16 v vs. standard calomel electrode. The anodic polarization curve for zirconium in air-saturated distilled water at 40°C was determined in the current-density range from 1.0×10^{-6} to 3.0×10^{-3} amp/cm^2. The potential rose in a linear fashion with the logarithm of current density, the slope being 0.07 v. A small amount of corrosion which increased with temperature was observed but not explained. (auth)

4216
Naval Research Lab.
WETTABILITY OF NYLON, POLYETHYLENE TEREPHTHALATE, AND POLYSTYRENE BY HYDROGEN-BONDING AND HALOGENATED LIQUIDS. A. H. Ellison and W. A. Zisman. May 5, 1954. 7p. (NRL-4362)

A study has been made of the wettability by a variety of liquids of smooth surfaces of polyethylene terephthalate, Nylon, and polystyrene. It is based on observations of the equilibrium contact angle, θ_E, formed by a liquid drop resting on the solid surface. Comparison of the results for Nylon with previous results for polyethylene and of those for polyethylene terephthalate with those for polystyrene showed that the wettability by polar hydrogen-bonding liquids is increased by the presence of both the amide group and the ester group in the solid surface, but to a much greater extent by the amide group. The wettability by organic liquids containing Cl, Br, or I is less affected by the amide or ester groups as might be expected from the inability of halogenated liquids to form hydrogen bonds. It is believed that hydrogen bonding takes place in the wetting of Nylon by water, glycerol, formamide, and thiodiglycol and does not take place in the wetting of polyethylene terephthalate by these liquids. It was found that perfluorolauric acid could be adsorbed on Nylon from n-decane solution rendering the Nylon surface oleophobic. (auth)

4217
Metals Research Lab., Carnegie Inst. of Tech.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING APRIL 1, 1954. R. F. Mehl and G. Derge. June 1954. 10p. Contract AT(30-1)-1024. (NYO-3698)

Measurement of the conductivities of molten Sb_2S_3 and Ni_3S_2 indicated that the former is ionic and the latter behaves as a metallic conductor. Molybdenum sulfide was found to lower the conductivity of Cu_2S in MoS_2-Cu_2S mixtures. However, the mixture remains in the semiconduction region. Determination of the mobility of Fe^{++} in liquid Fe silicate slags, using radioactive tracer techniques, indicated that the spreading of activity due to self-diffusion of radioactive Fe^{++} is insignificant as compared with that due to ionic migration. Electrolysis of $Al_2O_3-CaO-SiO_2$ slags was carried out at 1390°C in Zircon crucibles. For 3 different slags, oxygen was observed to evolve at the Pt anode. (For preceding period see NYO-3696.) (J.A.G.)

4218
Atomic Energy Project, Univ. of Calif., Los Angeles
STRONTIUM AND CALCIUM IN MUNICIPAL WATER SUPPLIES, THEIR OCCURRENCE AND REMOVAL. George V. Alexander, Ralph E. Nusbaum, and Norman S. MacDonald. May 20, 1954. 27p. Contract AT-04-1-GEN-12. (UCLA-293)

Samples of raw water and tap water were obtained from 50 cities located throughout the United States. Analyses for strontium, calcium, and magnesium were made by an emission spectrographic technique which required no preliminary concentration of the water samples. Comparison of the concentrations before and after chemical treatments indicated that reduction of strontium concentration accompanies removal of calcium. Inferences concerning the removal of radiostrontium from contaminated drinking water were drawn. (auth)

4219
TITANIUM OXIDES IN THE INTERVAL BETWEEN $TiO_2-Ti_2O_3$. N. E. Filonenki, V. I. Kudryavtsev, and I. V. Lavrov. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 86, 561-4(1952). 11p. (TT; 409)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-1422.

4220
CONSTITUTION OF NITRIC ACID. A. Hantzsh. Translated by Yvette De Felice from Ber. deut. chem. Ges. 58, 953-5(1925). 2p. (AEC-tr-1909)

4221
THE THERMOCHEMICAL PROPERTIES OF IONS IN AQUEOUS SOLUTION. S. I. Drakin and B. M. Yakushevskii [Yakushevsky]. Translated from Zhur. Fiz. Khim. 27, 1636-41[1953]. 9p. (AEC-tr-1917)

A theoretical foundation is given for the previously propounded assumption of the closeness of the properties of Cs^+ and I^- ions in aqueous solution. It has been found that the entropies of hydration depend upon the free energies of hydration of individual ions, expressible by the equation, $\Delta Z_g/e = 2.67\ \Delta S_g - 46$, which holds good for ions of all valencies. It has been found that the energies of hydration of ions that possess the structure of the noble gases are determined by their electrostatic characteristics, and an analysis is given of the methods of theoretically calculating the energy of hydration. A new method is proposed for calculating the absolute values of the thermochemical constants of ions in solution, based upon an analysis of the functional relationship of various parameters of the ions. (auth)

4222
DIFFUSION OF IONS IN PERMUTITE AND NATROLITE. Gunther Schulze. Translated from Z. physik. Chem. 89, 168-78(1914). 10p. (AEC-tr-1918)

4223
ON THE OXIDATION OF GRAPHITE BY ELECTRICAL DISCHARGES. V. Sihvonen. Translated from Ann. Acad. Sci. Fennicae (A) 38, Pt. 3, 3-22(1933). 12p. (AERE-Trans-11/3/5/412

4224
LIQUID STRUCTURE OF AQUEOUS NITRIC ACID SOLUTIONS. T. G. Owe Berg (Avesta Jernverks AB, Sweden). Acta Chem. Scand. 8, 374-82(1954) No. 3. (In English)

The heat of vaporization E_{HNO_3} of HNO_3 from aqueous nitric acid solutions has been determined from the temperature dependence of the partial vapor pressure of HNO_3. A formula for E_{HNO_3} similar to that for E_{HCl} derived previously is found. This formula is discussed and interpreted. The existence of the hydrate $2\,HNO_3 \cdot 3\,H_2O$ is confirmed. The structures of this and of lower hydrates are discussed. Those contain H_2O bound by a N–O bond. The existence of the ortho-acid $HNO_3 \cdot H_2O = H_3NO_3$ is discussed. (auth)

4225
VAPOR PRESSURES OF INORGANIC SUBSTANCES. XII. ZIRCONIUM DIOXIDE. Michael Hoch, Masaru Nakata, and Herrick L. Johnston (Ohio State Univ., Columbus). J. Am. Chem. Soc. 76, 2651-2(1954) May 20.

The vapor pressure of ZrO_2 has been determined by the method of Knudsen, between 2014 and 2290°K. ZrO_2 vaporizes undissociated as $ZrO_2(g)$, the heat of vaporization being $\Delta H^\circ_{298} = 153.6 \pm 1$ kcal. The vapor pressure can be represented by the equation $\log p(\text{atm.}) = -(34{,}383/T) - 7.98 \times 10^{-4}T + 11.98$ The heat of dissociation of ZrO(g) into gaseous atoms was found to be $D_0 = 365 \pm 5$ kcal. (auth)

4226
AN EXPERIMENTAL CONTRIBUTION TO THE PROBLEM OF ISOTOPE SEPARATION BY CHEMICAL MEANS. G. Wagner and A. Pelz (Technische Hochschule, Vienna, Austria) and M. J. Higatsberger (Univ. of Vienna, Austria). Monatsh. Chem. 85, 464-6(1954) Apr. 15. (In German).

Natural Li can be enriched in the Li^7 isotope by a precipitation of Li_2CO_3 from LiCl in a concentrated solution of Na_2CO_3 and $(NH_4)_2CO_3$. (J.S.R.)

ANALYTICAL PROCEDURES

4227
Atomic Energy Project, Univ. of Calif., Los Angeles
DETERMINATION OF TRIOSE PHOSPHATES: IDENTIFICATION OF THE TRIOSE CHROMOGEN AND PROPOSED MODIFICATIONS IN THE ALDOLASE METHOD OF SIBLEY AND LEHNINGER. William S. Beck. May 13, 1954. 27p. Contract AT-04-1-GEN-12. (UCLA-292)

Studies on the aldolase method of Sibley and Lehninger indicate that the chromogens derived from the triose phosphate hydrazones upon addition of 2,4-dinitrophenylhydrazine and NaOH are identical for glyceraldehyde-3-phosphate and dihydroxyacetone phosphate, consisting essentially of a mixture of methyl glyoxal 2,4-dinitrophenylosazone and pyruvic 2,4-dinitrophenylhydrazone. The reported difference in chromogenicity between the derivatives of the two triose phosphates is related to the rate of formation of the osazone derivatives. When the chromogen development reaction is interrupted at 10 minutes, the ratio of color intensity per mole between dihydroxyacetone phosphate derivative and glyceraldehyde-3-phosphate derivative is 1.8; at 60 minutes the ratio is 1.0. Careful timing of the 10-minute reaction permits an estimation of glyceraldehyde-3-phosphate and dihydroxyacetone phosphate in a mixture whose alkali-labile phosphorus is known, based on the difference in rate of osazone formation. For the aldolase assay, however, a 15-minute enzyme reaction and 60-minute chromogen development reaction are recommended to increase sensitivity and accuracy. The latter modification permits the convenience of a triose standard in place of the cumbersome alkali-labile phosphorus. (auth)

4228
METHOD PERMITTING THE DETERMINATION OF EXTREMELY SMALL QUANTITIES OF BORON IN ORGANIC MATTER. Gabriel Bertrand and H. Agulhon. Translated by Yvette De Felice from Compt. rend. 157, 1433-6(1913). 4p. (AEC-tr-1757)

4229
RAPID MEASUREMENT OF THE BORIC ACID WHICH OCCURS NORMALLY OR IS ADDED TO FOOD. Gabriel Bertrand and H. Agulhon. Translated by Yvette De Felice from Compt. rend. 158, 201-04(1914). 3p. (AEC-tr-1907)

4230
ON THE SEARCH FOR VERY SMALL QUANTITIES OF BORON IN ORGANISMS AND IN COMPLEX MIXTURES. Gabriel Bertrand and H. Agulhon. Translated by Yvette De Felice from Bull. soc. chim. France 7, 90-9(1910). 8p. (AEC-tr-1908)

4231
NOTE ON THE WET COMBUSTION OF ION EXCHANGE RESINS. Lennart W. Holm and Per Svensson (Nobel Inst. of Physics, Stockholm, Sweden). Acta Chem. Scand. 8, 527-9(1954) No. 3. (In English)

A brief discussion is presented on the determination of the content of Th and other elements in ion exchange resins by elution of the ion from the resin or by dry or wet combustion of the resin. An analysis is then made of the elute, ashes, or resulting solutions. (J.E.D.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

4232
ANALYSIS OF HEAVY WATER WITH A HIGH DEUTERIUM OXIDE CONTENT BY GRAVIMETRIC METHODS. (L'analyse Des Eaux Denses A Forte Teneur En Oxyde De Detérium Par Les Methodes Densimétriques). Rodolphe Villard. Translated from Bull. soc. chim. France (5), 16, 0.265-71 (1949). 17p. (AERE-Trans-11/3/5/211; AEC-tr-1299)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 4-128.

4233
HYDROGEN PEROXIDE AND ITS ANALOGUES. V. PHASE EQUILIBRIA IN THE SYSTEM D_2O–D_2O_2. Paul A. Giguère and E. A. Secco (Laval Univ., Quebec, Canada). Can. J. Chem. 32, 550-6(1954) May.

The cooling curves of a number of solutions of deuterium peroxide in heavy water in the concentration range 11 to 95% were measured in order to determine the solid–liquid phase diagram for the binary system. The apparatus of Herington and Handley, which uses a pulsing pressure for stirring the solutions, and a thermistor, was found to be particularly suitable for that purpose. The freezing-point curve of the deuterated compounds is closely similar to that of the hydrogen compounds, being shifted up only by about 4° for water-rich solutions and by 2° for peroxide-rich solutions. The melting point of the addition compound. $D_2O_2 \cdot 2D_2O$ very nearly coincides with one of the eutectic points at 46.2% D_2O_2 and –51.5°C; the other eutectic point is at 60.5% D_2O_2 and –55.1°C. By extrapolation, the melting point of pure deuterium peroxide is found to be 1.5°C as compared with –0.43°C for hydrogen peroxide. Concentrated solutions of deuterium peroxide exhibit an extreme tendency to supercool, resulting sometimes in formation of glasses

even at liquid-air temperature. The previous results of Foley and Giguère for the system $H_2O-H_2O_2$ were confirmed, specially as regards the melting point of the addition compound $H_2O_2 \cdot 2H_2O$. (auth)

FLUORINE AND FLUORINE COMPOUNDS

4234

THE ACTION OF FLUORINE ON SODIUM SULFATE, SULFITE AND THIOSULFATE. Marius Picon and Louis Domange. Translated by Jane Gurney from Compt. rend. 236, 704-06(1953). 4p. (AEC-tr-1910)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-2515.

4235

COMPLEX FLUORIDES OF QUADRI- AND QUINQUE-VALENT RUTHENIUM. M. A. Hepworth, R. D. Peacock, and P. L. Robinson (King's Coll., Newcastle-on-Tyne, England). J. Chem. Soc., 1197-1201(1954) Apr.

Complex fluorides of ruthenium involving the metal in the quadri- and quinque-valent states are described. Ability to prepare fluororuthenates of the type M(I) RuF_6 and N(II)$(RuF_6)_2$ depends upon the ionic radius of M(I) and N(II) and appears to be restricted to ions with values of 0.99 A and above. (auth)

4236

REACTIONS OF FLUOROCARBON RADICALS. PART XV. SYNTHESIS AND HYDRATION OF 1:1:1-TRIFLUOROBUT-2-YNE. R. N. Haszeldine and K. Leedham (Univ. Chemical Lab., Cambridge, England). J. Chem. Soc. 1261-4(1954) Apr.

1:1:1-Trifluorobut-2-yne was synthesized from trifluoroiodomethane and propyne via 1 : 1 : 1-trifluoro-3-iodobut-2-ene and 2:3-dibromo-1:1:1-trifluorobut-2-ene. Hydration of the butyne catalyzed by a mercury salt yields only 4:4:4-trifluorobutan-2-one, and the significance of this on the mechanism of hydration of acetylenes is discussed. (auth)

4237

PERFLUOROALKYL GRIGNARD AND GRIGNARD-TYPE REAGENTS. PART IV. TRIFLUOROMETHYL-MAGNESIUM IODIDE. R. N. Haszeldine (Univ. Chemical Lab., Cambridge, England). J. Chem. Soc., 1273-9(1954) Apr.

Trifluoromethylmagnesium iodide is prepared from trifluoroiodomethane only with difficulty. Neutral-molecule Lewis bases are the best solvents, and temperatures of $-30°$ to $-10°$ should be used. Fluoroform and polytetrafluoroethylene are produced by decomposition of the Grignard compound and the mechanism of formation of these compounds is discussed. The conversion of $CF_3 \cdot Mgl$ into CHF_3, $CF_3 \cdot CO_2H$, or $CF_3 \cdot CH_2 \cdot CH_2 \cdot OH$, and into the ketones $CF_3 \cdot CO \cdot R$ (R = Me, Et, Pr^n, CH_2F, CHF_2, $CF_3 \cdot CH_2$, CF_3, or C_3F_7) is described. (auth)

GRAPHITE

4238

EXTREMELY THIN CONDUCTIVE GRAPHITE COATINGS. William F. Lindsay (Allis-Chalmers Manufacturing Co., Milwaukee, Wis.). Rev. Sci. Instr. 25, 524(1954) May

A method has been developed for spraying a conductive coating of uniformly thin layer graphite on thin plastic films (~25$\mu g/cm^2$ or more) such as might be used as windows in Geiger, proportional, or other counting tubes. The coating is quick drying and more than 30 $\mu g/cm^2$ in thickness. (L.T.W.)

RADIATION CHEMISTRY

4239

Wisconsin Univ.

ISOMER, NEUTRON ENERGY, AND RADIATION DOSAGE EFFECTS ON REACTIONS ACTIVATED BY RADIATIVE NEUTRON CAPTURE IN ORGANIC BROMIDES. J. C. W. Chien and J. E. Willard. [1953]. 7p. Contract [AT(11-1)-32]. (AECU-2879)

An investigation of the reactions activated by radiative neutron capture in organic bromides led to the conclusion that the apparent isomer effect was due to impurities. Related information on neutron energy effects and on the effect of γ-ray dosage on organic yield is included. (C.H.)

4240

RADIATION CHEMISTRY. I. V. Vereshchinskii. Translated from Uspekhi Khim. 20, 288-308(1951). 48p. (AEC-tr-1912)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 5-4705.

4241

IRRADIATION OF CHLOROFORM–WATER SYSTEMS WITH Co^{60} GAMMA-RAYS AND BETATRON X RAYS. R. W. Hummel, A. B. Van Cleave, and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Chem. 32, 522-31(1954) May.

The production of acid from two commercial brands of chloroform on exposure to Co^{60} gamma rays and high-energy x rays from a betatron was measured. Inhibitor-free chloroform liberates acid in amounts varying linearly with the radiation dose. The specific yield, in micromoles of acid produced per liter of chloroform per kiloroentgen, varies inversely as the square root of the dose rate. The specific yields are slightly less for betatron radiations, compared with Co^{60} gamma rays. The average lifetime of the free radical chains is about one second. (auth)

4242

ON THE SPEED–INTENSITY RELATION IN THE POLYMERIZATION OF STYRENE BY γ RADIATION. Adolphe Chapiro and Philippe Wahl. Compt. rend. 238, 1803-5 (1954) May 3. (In French)

The speed–intensity relationship in the polymerization of styrene by γ rays was studied over an intensity range from 0.29 to 370 r/min. The variations of the degree of polymerization as a function of time are graphed logarithmically. (J.S.R.)

RADIATION EFFECTS

4243

SOME EFFECTS OF IRRADIATION ON NYLON AND POLYETHYLENE TEREPHTHALATE. K. Little (Atomic Energy Research Establishment, Harwell, Berks (England)). Nature 173, 680(1954) Apr. 10.

Samples of 66 Nylon and polyethylene terephthalate (Terylene) were irradiated in BEPO with approximately 5×10^{18} and 1.5×10^{18} n/cm^2 respectively. The behavior of the two materials under irradiation was found to be entirely different; the differences are described. (A.G.W.)

4244

EFFECT OF MOLECULAR WEIGHT ON THE CROSS-LINKING OF SILOXANES BY HIGH-ENERGY RADIATION. A. Charlesby (Atomic Energy Research Establishment, Harwell, Berks (England)). Nature 173, 679-80(1954) Apr. 10.

Samples of polydimethylsiloxanes of various viscosities were irradiated in the atomic pile at Harwell or by Co^{60} sources. The minimum radiation dose (R) needed for formation of a gel structure was recorded. Over the range of molecular weights 2,000 to 115×10^3, the product RM was found to be constant within experimental error. This observation indicates that the radiation dose needed to produce an average of one cross-link per weight average molecule is inversely proportional

to the number of units in the molecule. Hence the radiation required to cross-link a given proportion of the monomer units is independent of molecular length. (A.G.W.)

4245

POLYMER PRODUCTION IN RADIOLYSIS OF BENZENE. W. N. Patrick and Milton Burton (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 76, 2626-9(1954) May 20.

Irradiation of liquid benzene with 1.5 Mv electrons gives polymer as a non-volatile product with a 100-ev yield G(C_6H_6 → polymer) = 0.75 independent of intensity and total energy input. Average molecular weight increases non-linearly with energy input; the maximum value observed was ~530. At the same time G(double bond formation) decreases linearly with input independent of intensity. In explanation of the results it is suggested that a fixed fraction of the primarily excited benzene molecules are excited to a particular energy level and then react to give polymer formation. (auth)

4246

DECOMPOSITION OF FUSED SODIUM HYDROXIDE BY FAST ELECTRONS. C. Hochanadel (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 76, 2675(1954) May 20.

NaOH, melted under vacuum, cooled, and irradiated with 1.3-Mev electrons, was found to contain 0.05 ml of H_2 after 40 min. This corresponds to an extremely small net yield of 4×10^{-4} molecules/100 ev energy absorbed. A repetition of the experiment by heating a degassed sample in the absence of radiation produced approximately the same amount of H_2, a fact indicating that the gas probably resulted from corrosion of the crucible and that NaOH is stable under irradiation. (J.S.R.)

4247

THE DEGRADATION OF SOLID POLYMETHYLMETHACRYLATE BY IONIZING RADIATION. P. Alexander (Imperial Coll., London, England) and A. Charlesby and M. Ross (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A223, 392-404 (1954) May 6.

When polymethylmethacrylate in the solid form is irradiated in the atomic pile, or with γ radiation, two reactions predominate: breakdown of the main chain, and decomposition of the side chain with evolution of gases. The former was followed by changes in viscosity, the molecular weight of the irradiated polymer being inversely proportional to the radiation dose (plus a small quantity of R_0 which depends on the initial molecular weight). The degradation is thought to proceed by random rupture of main-chain C—C bonds by rearrangement of the excited polymer, and 61 ev are absorbed per fractured bond. For each main-chain rupture approximately one ester side chain is also decomposed. The cage effect is thought to prevent direct dissociation, and reaction occurs by rearrangement of the molecule to give relatively stable entities. Added substances reduce the amount of degradation, possibly by transfer of energy from the excited polymer molecule. This is only possible if the excited molecules have an appreciable life before decomposition. Viscosity measurements on irradiated polymethylmethacrylate in the solid form offer a possible means of measuring high-energy radiation doses in the range of about 1 million röntgens and upwards. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4248

Mound Lab.

THE MICROMETALLURGY OF ACTINIUM. J. G. Stites, Jr., M. L. Salutsky, and B. D. Stone. Aug. 5, 1953. 16p. Contract AT-33-1-GEN-53. (MLM-881)

Actinium metal was prepared on the milligram scale by the reduction of AcF_3 with Li vapor. A high-purity product with a yield of 95% was obtained. It resembles La metal both chemically and physically. The melting point of Ac metal was found to be 1,050 ± 50°C. The relationship of the melting point of Ac metal to the melting points of metals adjacent to it in the periodic table is discussed. (auth)

4249

LANTHANON COMPLEXES WITH ETHYLENEDIAMINETETRA-ACETIC ACID. PART IV. R. C. Vickery (Division of Industrial Chemistry, C.S.I.R.O., Melbourne, Australia). J. Chem. Soc., 1181-8(1954) Apr.

The displacement of lanthanons from anionic complexes with ethylenediaminetetraacetic acid (H_4enta) by added cationic lanthanons has been studied spectrophotometrically. The displacement proceeds in order of decreasing atomic number and stability constant of the lanthanon complex; i.e., the cation of a lanthanon of higher atomic number and higher stability constant will displace from anionic "enta" complex a lanthanon of lower atomic number and lower stability constant. This principle of diaplacement has been applied to lanthanon separation, pure [Ln enta]$^-$ complexes being progressively converted into cationic form by the addition of calculated quantities of cationic lanthanon. The lanthanon displaced from anionic complex is then extracted from solution by a cation-exchange resin. Good separations of many of the lanthanons have thus been achieved although the pairs praseodymium-neodymium and dysprosium-holmium and the triad samarium-europium-gadolinium remain recalcitrant. Lanthanum, samarium, thulium, ytterbium, and lutetium are readily prepared in good purity by this technique, and satisfactory concentrations of terbium and dysprosium are readily achieved. (auth)

SEPARATION PROCEDURES

4250

Atomic Energy Research Establishment, Harwell, Berks (England)

THE PURIFICATION OF COMMERCIAL POTASSIUM. G. W. Morsley. Jan. 1954. 18p. (AERE-M/R-1371)

Treatment of commercial K with O_2 followed by filtration at its melting point (63.7°C) will remove alkali earths and should reduce the concentration of Na to a low value (<100 ppm). Properly controlled high-vacuum distillation of filtered K in the temperature range 200 to 350°C will reduce to negligible proportions most of the remaining impurities, in particular, H_2, O_2, halides, alkali earth, and heavy metals. Furthermore, this treatment should result in a significant lowering of the Na content. However, the complete removal of Na (to <1 ppm) can be achieved only by either a fractionating procedure or by repeated distillation of the metal in the presence of K_2O. (auth)

SORPTION PHENOMENA

4251

THE ADSORPTION OF GASES ON NICKEL OXIDE. R. M. Dell and F. S. Stone (Univ. of Bristol, England). Trans. Faraday Soc. 50, 501-10(1954) May.

An investigation has been made of the adsorption of gases on thin nickel oxide films present as a layer on nickel metal. The heats of adsorption of oxygen, carbon monoxide, and carbon dioxide have been measured calorimetrically, and the formation of an adsorbed complex with a formula CO_2 has been studied in detail. The catalytic oxidation of carbon monoxide, which proceeds at 20°, has been briefly investigated, and the results are correlated with the adsorption studies. Upon heating in vacuo, adsorbed oxygen is removed by incorporation as nickel oxide rather than by desorption, so the adsorption of oxygen is to be regarded as the first

stage in the further oxidation of the underlying metal. The degree of regeneration of the surface, however, depends critically both on the temperature of baking-out and on the thickness of the oxide film. These results are discussed in terms of the mechanism of the oxidation and the properties of nickel oxide as a semiconductor. (auth)

SPECTROSCOPY

4252

THE USE OF ILLUMINATORS IN INVESTIGATING THE LOW FREQUENCY SCATTERING SPECTRA OF ORGANIC CRYSTALS. A. V. Korshunov and V. A. Sel'kin. Translated from Zhur. Tekh. Fiz. 20, 745-9(1950). 5p. (AERE-Trans-11/3/3/396)

4253

ANALYSIS OF HYDROGEN-DEUTERIUM MIXTURES, AND HEAVY- AND ORDINARY-WATER MIXTURES, BY MEANS OF A MASS SPECTROMETER. (Analyse Des Mélanges Hydrogène-Deuterium-Et Des Mélanges D'eau Lourde Et D'eau Légère-Au Moyen Du Spectromètre De Masse). J. Chenouard, J. Gueron, and E. Roth. Translation of Report CEA-87, (1951). 35p. (AERE-Trans-11/3/5/215; AEC-tr-1274)

Methods for the isotopic analysis of a mixture of light water and heavy water are reviewed, and the use of a mass spectrometer for analysis of mixtures of deuterium and hydrogen and for determinations of the composition of waters enriched with deuterium oxide is discussed in detail. (C.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

4254

[Montreal Lab. (Canada)]

ELECTROCHEMICAL STUDIES OF THE TWO REDUCED STATES OF PLUTONIUM. H. G. Heal. June 13, 1945. 19p. (CI-84)

The existence of two fluoride-insoluble valency states of Pu was demonstrated electrochemically. Approximate values for the oxidation-reduction potential of the couple in 1N sulfuric, hydrochloric, and perchloric acids were determined, and the difference of valency between the two states appears to be one unit. A practical procedure for cathodic reduction of milligram amounts of the element is described. (auth)

TRITIUM AND TRITIUM COMPOUNDS

4255

Knolls Atomic Power Lab.

THE SOLUBILITY OF HYDROGEN AND TRITIUM IN PALLADIUM BLACK. R. L. Favreau, R. E. Patterson, D. Randall, and O. N. Salmon. Apr. 15, 1954. 38p. Contract W-31-109-eng-52. (KAPL-1036)

The solubilities of hydrogen and tritium in palladium black were measured in the temperature range 200 to 400°C and at pressures below half an atmosphere. In this region, solubility is proportional to the square root of the equilibrium pressure. The variation of solubility with temperature was determined for both hydrogen and tritium in this range. From these relationships, the following heats of solution were obtained: $\Delta H_S\ (H_2) = -4000 \pm 110$ cal/mol; $\Delta H_S\ (T_2) = -950 \pm 300$ cal/mol. The ratio of the solubility of tritium to that of hydrogen was calculated and compared with existing data for deuterium and hydrogen. (auth)

WASTE DISPOSAL

4256

Mound Lab.

DECONTAMINATION OF LIQUID WASTES BY IRON SULFIDE, IRON HYDROXIDE, AND CALCIUM PHOSPHATE PRECIPITATIONS. (FINAL REPORT). C. S. Lowe, L. L. Bentz, J. R. Heiks, F. C. Mead, Jr., E. L. Murphy, E. Orban, F. Reichel, C. E. Shoemaker, and T. C. Tesdahl. Dec. 28, 1953. Decl. with deletions May 21, 1954. 21p. Contract AT-33-1-GEN-53. (AECD-3632; MLM-662(rev.))

Chemical precipitation methods for the decontamination of radioactive wastes have been studied at Mound Laboratory, and a highly successful process based on the adsorption and/or coprecipitation of fission products by ferrous sulfide, ferrous hydroxide, and calcium phosphate precipitates has been developed. This process has been demonstrated to successfully decontaminate a variety of wastes and to show special promise in decontaminating those of high level activity and high salt content. Decontamination factors of the order of 5×10^2 are obtained for one ferrous sulfide, ferrous hydroxide-calcium phosphate cycle, with a decontamination of 10^5 for a 3-cycle process. Extremely high volume reductions are realized by filtering, with volume reductions of 10 to 1 expected by settling. Laboratory work on several different types of wastes has been completed. (auth)

ENGINEERING

4257

Southwest Research Inst.

DEVELOPMENT OF POLYNUCLEAR AROMATIC COMPOUNDS FOR USE AS HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS. QUARTERLY REPORT NO. 1 [FOR] AUGUST 1–NOVEMBER 1, 1953. Charles F. Raley, Jr. Nov. 15, 1953. 19p. Contract AF-33(616)-276, Technical Report No. 5. (NP-5132)

HEAT TRANSFER AND FLUID FLOW

4258

Carbide and Carbon Chemicals Co. (K-25)

MOLECULAR TRANSPORT THROUGH A SHORT CAPILLARY. W. H. Eberhardt. May 24, 1954. 25p. Contract W-7405-Eng-26. (K-1100)

In a previous report (K-992), a novel abstraction of the density distribution in a short capillary was suggested, and the transport properties and momentum loss at the midpoint of the capillary were studied. This effective density function is employed to study several additional properties of the short capillary. The density function is shown to be quite accurately self-consistent by a calculation of the number of molecules striking the wall and comparison of this calculated number with the assumed function. The density gradient inside the channel is shown to be unrelated to that suggested by the Rayleigh-Maxwell end correction, but an approximate relation is presented which allows a good estimate of the effective density function without a detailed calculation. The total momentum lost per second to the walls and that carried by the gas entering and leaving the system are calculated. The sum of these three terms is identically equal to the over-all pressure drop times the cross-sectional area as required by the definition of pressure. The arguments developed for a single short capillary are extended to a series of short capillaries as a model for a tortuous channel. Although the calculation must be considered as suggestive only, the results should provide a guide for an intuitive understanding of such a model. (auth)

4259

HEAT TRANSFER, DIFFUSION, AND EVAPORATION. (Warmeubergang, Diffusion und Verdunstung.) Wilhelm

Nusselt. Translated from Z. Angew. Math. u. Mech. 10, 105-21(1930). 37p. (NACA-TM-1367)

The general similarity of heat and mass transfer (diffusion) processes is discussed, with particular reference to the lack of complete identity of the relations governing the two phenomena. It is indicated that, for example, the boundary conditions in the two cases at the surface of a body will not be the same. The correct equation of diffusion is given for various simple cases. Generalized relations for combined heat and mass transfer are then evolved for particular situations, comparisons being made among several different approaches to the problem. Finally, the effect of a buoyancy force field on the generalized relations is considered, with special reference to the evaporation of water. (tr-auth)

4260

Langley Aeronautical Lab., NACA

AN EXPERIMENTAL STUDY OF POROSITY CHARACTERISTICS OF PERFORATED MATERIALS IN NORMAL AND PARALLEL FLOW. George M. Stokes, Don D. Davis, Jr., and Thomas B. Sellers. Aug. 4, 1953. 24p. (NACA-TN-3085)

Experimental data were obtained to show some of the flow characteristics of perforated materials when subjected to airstreams directed normal and parallel to the surface of the material. The results of these tests showed that the effective porosity of the material dropped markedly as the stream velocity increased. The most important parameter for determining the discharge coefficients of the perforated material was the ratio of the stream velocity to the free jet velocity. (NACA abst.)

4261

ELECTRONIC FLOWMETER SYSTEM. Henry P. Kalmus (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 25, 201-6(1954) Mar.

A flowmeter system is described which gives continuous readings of flow velocity with a fast rate of response. The "upstream-downstream" method is used in which velocity of a fluid is determined by measuring the phase difference between an upstream and downstream ultrasonic wave of, say, 100,000 cycles. The functions of the transmitting and receiving transducers are interchanged at a fast rate, say 100 cycles per second, allowing the use of a synchronous rectifier. In this way, no long time stability of the phasemeter is required so that very small flow rates can be measured. Velocities as low as 0.1 cm/sec were successfully measured. A special commutator switch with very low transfer capacitance and, as an alternative, an electronic switch are described. The transducers used are barium titanate crystals mounted in a manner so that their contact with the fluid is avoided. (auth)

TRACER APPLICATIONS

4262

Rock Island Arsenal Lab.

USE OF RADIOACTIVE ISOTOPES IN MATERIALS RESEARCH, DEVELOPMENT AND TESTING. REPORT NO. 3. RADIOCOBALT GAGE FOR DETERMINING LIQUID LEVEL. Stanley L. Eisler. Jan. 30, 1952. 17p. (ATI-168794)

A gage is described which employs a radiocobalt source and a count rate meter for measuring the liquid level in the closed system of a Pfaudler vacuum evaporator. (C.H.)

VACUUM SYSTEMS

4263

A THREE-WAY VACUUM VALVE. F. S. Stein (Westinghouse Research Labs., East Pittsburgh, Penna.). Rev. Sci. Instr. 25, 515-16(1954) May.

The valve is a modification of a recently described valve (Shatford, J. Sci. Instr. 29, 336 (1952)) using O-ring sliding seals. It has the advantage of possessing positive seating action at either extreme position in addition to the peripheral O-ring seals, thus minimizing the possibility of leakage. The valve is self-lubricating, uses a square stock for the valve body, uses large channels and orifices, and is compact and of simple construction. (L.T.W.)

4264

A HIGH-VACUUM SEAL-OFF VALVE. R. J. Richards (Cryogenic Engineering Lab., Boulder, Colo.). Rev. Sci. Instr. 25, 520-1(1954) May

The seal-off valve described provides a permanent pumping tap which may be used many times without soldering or welding. The vacuum system is not exposed to the atmosphere when re-evacuation becomes necessary. In addition, the seal-off valve provides a valve bonnet, handle, and stem which can be readily removed and used with any number of seal-off seats leaving only the closed valve seat on the evacuated apparatus. (L.T.W.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

4265

Lewis Flight Propulsion Lab., NACA

INVESTIGATION OF TITANIUM CARBIDE BASE CERAMALS CONTAINING EITHER NICKEL OR COBALT FOR USE AS GAS-TURBINE BLADES. C. A. Hoffman and A. L. Cooper. Aug. 18, 1952. 33p. (NACA-RM-E52H05)

4266

Lewis Flight Propulsion Lab., NACA

PRELIMINARY INVESTIGATION OF THE "FREEZE-CASTING" METHOD FOR FORMING REFRACTORY POWDERS. W. A. Maxwell, R. S. Gurnick, and A. C. Francisco. Dec. 8, 1953. 19p. (NACA-RM-E53L21)

A method of preparing intricately shaped objects from refractory powders was investigated. The method consists in preparing an extremely thick slip with a small amount of binder, casting the slip into a mold, and freezing to retain the shape of the casting. The casting is then dried by sublimation and may subsequently be sintered by conventional means. It was found possible to cast high-solid-content slips by employing vibration during the casting process. Turbosupercharger blades of good appearance and free from radiographic flaws were produced. The factors affecting the density of a casting before sintering were determined. (NACA)

4267

Illinois Univ.

ALUMINUM TITANATE AS A POROUS INSULATING MATERIAL FOR THE PROTECTION OF METAL. William F. Zimmerman, W. J. Plankenhorn, and Dwight G. Bennett. May 15, 1953. 21p. Contract W33-038-ac-14520. (WADC-TR-53-187; AD-14763)

Ceramic bodies composed of prereacted aluminum titanate and varied percentages of Florida Kaolin, Tennessee No. 5 Ball Clay, Fulton Plastic Clay, or barium zirconium silicate were dry pressed into briquettes and fired at 2700, 2800, or 2900°F. They were compared with respect to their physical properties including firing shrinkage, modulus of rupture, apparent porosity, bulk density, and thermal expansion. Body AT 11, containing 60% aluminum titanate and

40% Florida Kaolin had the best combination of physical properties important in the development of a refractory light weight insulating material. Additions of either sawdust or charcoal, as a burn-out agent, to body AT 11 resulted in the production of a light weight insulating material having physical properties similar to those of commercial insulating materials but with the added feature of a lower coefficient of expansion. (auth)

4268

HIGH-TEMPERATURE ZIRCONIUM PHOSPHATES. D. E. Harrison, H. A. McKinstry, and F. A. Hummel (Pennsylvania State Univ., State College). J. Am. Ceram. Soc. 37, 277-80(1954) June.

The existence of two zirconium phosphate compounds has been established. The "normal" phosphate, ZrP_2O_7, has a reversible inversion at 300°C and dissociates to the zirconyl compound, $(ZrO)_2P_2O_7$, at 1550°C, with the simultaneous loss of P_2O_5 as vapor. The room-temperature form of ZrP_2O_7 is cubic with refractive index 1.657 ± 0.003. The zirconyl compound has a stable existence to temperatures around 1600°C and is characterized by a very low linear thermal-expansion coefficient. (auth)

CORROSION

4269

Lewis Flight Propulsion Lab., NACA

KINETIC STUDY OF MASS TRANSFER BY SODIUM HYDROXIDE IN NICKEL UNDER FREE-CONVECTION CONDITIONS. Don R. Mosher and Robert A. Lad. Dec. 3, 1953. 14p. (NACA-RM-E53K24)

An investigation was conducted using static capsules fabricated from "L" nickel tubing to determine the effect of temperature level, temperature gradient, and test duration on corrosion and mass transfer by molten sodium hydroxide under free-convection conditions. A base temperature range from 1000 to 1600°F with temperature differences to 500° was studied. The rate of mass transfer was found to be strongly dependent on both temperature level and gradient. The rate shows little tendency to decrease for test durations up to 200 hours, although the concentration of nickel in the melt approaches a limiting value after 100 hours. (auth)

GEOLOGY AND MINERALOGY

4270

Arizona Univ.

STUDIES IN SEDIMENTOLOGY OF THE SHINARUMP CONGLOMERATE OF NORTHEASTERN ARIZONA. Edwin D. McKee, Charles G. Evensen, and Wilbur David Grundy. Aug. 1953. 48p. Contract AT(30-1)-126. (RME-3089)

Studies of sedimentary features of the Shinarump conglomerate in northeastern Arizona made during the summer of 1952 include analyses of composition, texture, and cross-stratification, examination of small-scale primary structures and of features of the basal contact, and the accumulation of data on stratigraphic relations and the controls of mineralization. Data pertaining to paleogeography of the Shinarump conglomerate in Arizona suggest that much of the detrital sediment included in the sandstones and conglomerates was transported by streams from distant sources to the south and southwest; that accumulations of mud pellets and mud blocks were derived locally from non-lithified or partially lithified sediment of the underlying Moenkopi formation. Statistical analyses of cross-strata and experimental work in the laboratory suggest that the areas and types of deposition were rigidly controlled by water level. Relation of mineral deposits to sedimentary structures indicates that lateral and downward moving solutions, following the paths taken by ground water today, introduced the mineral matter. (auth)

4271

Columbia Univ.

INTERPRETATION AND VALUATION OF URANIUM OCCURRENCES IN THE BIRD SPRING AND ADJACENT MINING DISTRICTS, NEVADA. (PRELIMINARY REPORT). Charles H. Behre, Jr. and Paul B. Barton, Jr. July 8, 1954. 35p., 1 illus. (RME-3091; CU-1-53-AT-1550-Geol.)

This is a preliminary report on the uranium mineralization in the region around Goodsprings, Clark Co., Nev. The conclusions reached are based on limited data and must be regarded as tentative only. Two areas of uranium mineralization are observed in the Goodsprings district: (1) east of the mining area and (2) in the mines. In occurrences exclusive of the mines a yellow, radioactive mineral (tentatively identified as carnotite) is found as thin films and specks on fractures in Pennsylvanian and Permian sediments and Tertiary(?) tuffs and gravels. These deposits are not of economic importance. Many of the local base-metal mines contain radioactive hydrozincite, "limonite," ferruginous chert, aurichalcite, chrysocolla, and jarosite(?) which are believed to fix the uranium by adsorption of the uranyl ion. Deposits of this type probably do not contain enough unanium to be of economic significance. Other mines (i. e., the Green Monster and Singer-Tiffin) contain uranium minerals such as kasolite, dumontite(?), and carnotite(??) in addition to the radioactive oxidation products of the base-metal ores. These mines merit further study to determine the extent of mineralization. Two possible sources of the uranium are primary uranium minerals in the ore body and tuffs from which the uranium could have been leached. (auth)

4272

Geological Survey

RADIOACTIVITY OF SOME COAL AND SHALE OF PENNSYLVANIAN AGE IN OHIO. John L. Snider. July 1953. 22p. (TEI-404)

Channel samples of the commercially important coal beds and associated rocks in the Pottsville, Allegheny, and Monongahela series of the Pennsylvanian system were collected in eastern Ohio. Equivalent uranium content of 0.001% or more was determined in the laboratory for five samples. The uranium content of the coal is less than the equivalent uranium content indicated by radioactivity measurements. None of the samples collected contain recoverable quantities of uranium in the ash. (auth)

4273

Geological Survey

RECONNAISSANCE FOR URANIUM IN COAL AND SHALE IN SOUTHERN WEST VIRGINIA AND SOUTHWESTERN VIRGINIA. John L. Snider. July 1953. 28p. (TEI-409)

A reconnaissance for uranium in southern West Virginia and southwestern Virginia included field measurements of radioactivity of measured sections and the collection of channel samples of coal, shale, and clay for laboratory determination of radioactivity. All samples of bituminous coal have less than 0.001% equivalent uranium. A sample of the Merrimac coal, a semianthracite coal of Mississippian age from Montgomery Co., Va., may contain as much as 0.001% equivalent uranium. Further investigation of the coal in this area as a source of uranium is not recommended. Samples of Upper Devonian shale contain 0.003 to 0.004% equivalent uranium, and areas where these rocks crop out may deserve more investigation. Checking the measured sections with a portable scintillation meter did not reveal any beds with abnormally high radioactivity. (auth)

4274

THE SCALE-MODELING OF ALTERNATING ELECTROMAGNETIC FIELDS FOR PURPOSES OF GEOPHYSICAL PROSPECTING. A. G. Tarkhov. Translated by E. R. Hope

from Izvest. Akad. Nauk S.S.S.R., Ser. Geograf. i Geofiz. 17, 318-23(1953). 11p. (AEC-tr-1905)

4275

THE TRANSPORT AND DEPOSITION OF URANIUM, IONIUM AND RADIUM IN RIVERS, OCEANS AND OCEAN SEDIMENTS. Heinrich D. Holland and J. Laurence Kulp (Lamont Geological Observatory, Palisades, N. Y.). Geochim. et Cosmochim. Acta 5, 197-213(1954) May.

The important factors controlling the concentration of the radioelements in the oceans are the influx, the rate of radioactive decay, and the rate at which the radioelements are removed by sedimentation. With such data as are available for the concentration of uranium and radium in ocean water, their rates of influx, and their rates of deposition, it is possible to estimate the concentration of uranium in sea water $3.1 \pm 1 \times 10^{-15}$ gm/cc, and the amount of ionium, annually transported into the oceans. It may be further concluded that in the geochemistry of uranium, influx and deposition in shallow water are of major importance; in the case of ionium, influx and deep water deposition seem most important; and in the case of radium, the production by radioactive decay of ionium, the disintegration of radium itself, and deep water deposition are important factors. Ionium is not in equilibrium with uranium in ocean water. (auth)

4276

THE MECHANISM OF REMOVAL OF IONIUM AND RADIUM FROM THE OCEANS. Heinrich D. Holland and J. Laurence Kulp (Lamont Geological Observatory, Palisades, N. Y.). Geochim. et Cosmochim. Acta 5, 214-24(1954) May.

By the use of radiothorium (Th^{228}) and thorium X (Ra^{224}) as tracers for ionium (Th^{230}) and Ra^{226} respectively, it has been possible to study the adsorption and base exchange of these elements on deep-sea sediments. Extrapolation of the adsorption data obtained with these tracers to the region of the actual concentration of ionium and radium in sea water shows that the quantity of ionium and radium adsorbed is comparable to that observed on recent deep-sea sediments. This seems to demonstrate that base exchange is the mechanism by which ionium and radium are removed from ocean water. In turn this establishes the interpretation of the radium vs. depth curves as reflecting ionium decay which is the basis for the Ionium Method of age determination. Finally, this information delimits the variables which must be controlled in applying this method to the dating of events on the ocean floor. (auth)

4277

THE GEOLOGICAL SIGNIFICANCE OF VARIATIONS IN THE ABUNDANCES OF THE ISOTOPES OF SILICON IN ROCKS. F. S. Grant (Univ. of Toronto, Ontario, Canada). Geochim. et Cosmochim. Acta 5, 225-42(1954) May.

Physical and chemical processes which may lead to variations in the isotopic content of rocks are discussed in this paper, with special emphasis given to the processes of chemical exchange which may occur during the early stages of formation. Quantitative calculations deriving from physical understanding of those mechanisms have been applied whenever possible to the case of silicon, and lead to the following conclusions relating the isotopic abundances of silicon to the geological history of the mineral: (i) limits may be calculated for the isotopic content of rocks which formed in equilibrium from a common magma, (ii) it is unlikely that diffusion processes play any part in the separation of silicon isotopes, either in the solid or liquid state, (iii) analysis of abundances in a given mineral can reveal whether or not sedimentation during its history is a necessary hypothesis. The paper is entirely theoretical, and except for a few minor extensions to existing methods, it contains no original developments. (auth)

METALS AND METALLURGY

4278

Los Alamos Scientific Lab.

DYNAMIC DETERMINATION OF THE COMPRESSIBILITY OF METALS. Roy W. Goranson, Dennison Bancroft, Blendin L. Burton, Theodore Blechar, Edwin E. Houston, Elisabeth F. Gittings, Stanley A. Landeen. [1953?]. Decl. May 12, 1954. 27p. Contract [W-7405-eng-36]. (AECD-3633)

Equation-of-state data for duralumin in the pressure range from 0.1 to 0.3 megabar were determined dynamically by measuring shock and free surface velocity electrically in a plate of 24 ST duralumin, which was stressed by a high explosive detonation. The theory is presented which allows comparison with data obtained by other experimenters, requiring the relationship between pressure and compression either at constant entropy or constant temperature. The empirical form chosen for the equation of state $p = \alpha\mu + \beta\mu^2$, expresses the pressure as a quadratic function of the compression. Experimental techniques are described in detail. Five points are given for equation of state of duralumin in the pressure range from approximately 0.15 to 0.33 megabar. Some data are also presented for cadmium and steel. (auth)

4279

Argonne National Lab.

NITRIDED STAINLESS STEELS FOR HIGH-TEMPERATURE WATER SERVICE. Kermit Anderson. Mar 1954. 89p. Contract W-31-109-eng-38. (ANL-5192)

The nitriding process, the variables affecting it, and an evaluation of the corrosion and wear resistance of nitrided materials for use in high-temperature, oxygenated water are discussed. The results of concurrent investigations by Argonne, Battelle, Babcock & Wilcox, and Westinghouse are correlated and analyzed. Data are presented in both tabular and graphical form. (auth)

4280

Battelle Memorial Inst.

WELDING OF HIGH-STRENGTH STAINLESS STEELS FOR PRESSURE VESSELS. J. J. Vagi, V. R. Thompson, and D. C. Martin. May 5, 1954. 50p. Contract W-7405-eng-92. (BMI-911)

Welding tests on stainless steels indicate that AMS 5643, AMS 5528, Inconel "X", and AMS 5616 stainless can be welded under conditions of high restraint, using the inert-gas-shielded tungsten-arc process. Yield strengths of 100,000 psi or higher in weldments in AMS 5616, AMS 5643, and AMS 5528 were obtained by using postwelding heat treatments. However, to obtain reasonable elongations, it is necessary to solution anneal as part of the postwelding heat treatment (1700 to 1900°F, depending on the alloy). Preliminary tests on AMS 5735 stainless steel showed that this steel is extremely sensitive to hot cracking. X-ray-diffraction and metallographic studies show the presence of a low-melting grain-boundary film. Extensive studies of the welding characteristics of Inconel "X", AMS 5528, and Timken 17-22A(S) low-alloy steel clad on one side with AISI 347 stainless steel were not performed. However, the results of preliminary welding studies on Inconel "X" and AMS 5528 were promising. Similar tests on Timken 17-22A(S) indicated that heat treatment of the partly welded joint may be necessary to produce crack-free welds in this material. (auth)

4281

Armour Research Foundation

PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS. REPORT NO. 14. THE ZIRCONIUM-NITROGEN SYSTEM. REPORT NO. 4—SUMMARY. APRIL 1, 1953–MARCH 31. 1954. R. F. Domagala and D. J. McPherson. Mar. 31, 1954. 47p. Contract AT(11-1)-149. (COO-190)

Iodide zirconium was combined with calculated amounts of nitrided zirconium sponge and arc melted to prepare alloys in the 0 to 6 wt.% nitrogen region. Annealing treatments were carried out at 21 temperature levels. Metallographic examination of the heat-treated specimens permitted construction of the binary phase diagram from 0 to 6 wt.% nitrogen (0 to 30 at.%). Features of the diagram include the peritectic formation of beta solid solution at 1880°C by the reaction $L + \alpha \rightarrow \beta$. The wt.% compositions of the reacting phases are L: 0.7% N, α: 3.0% N, and β: 0.8% N. Alpha solid solution also forms by a peritectic reaction at 1985°C, $L + ZrN \rightarrow \alpha$. Phases entering into the reaction are of the following compositions: L: 2.4% N, ZrN: ~11.5% N, and α: 4.8% N. The maximum solubility of nitrogen is 0.8% in beta zirconium and 4.8% in alpha zirconium. To complement the metallographic data, an x-ray study was made of nitrided materials in the 6 to 13 wt.% (30 to 50 at.%) nitrogen region. This was necessary because serious nitrogen losses were experienced when attempts were made to arc melt these high nitrogen alloys. Additional data obtained from this study permitted a semiquantitative placement of the α + ZrN/ZrN boundary. The intermediate phase ZrN, which is reported to melt at 2980°C, has a homogeneity range extending from about 11.5% N at 1985°C down to about 13% N at 600°C. No other singular phase exists between zirconium and ZrN. (auth)

4282

Ames Lab.

ETCHING METALS BY IONIC BOMBARDMENT. A. J. Carlson, J. T. Williams, B. A. Rogers, and E. J. Manthos. May 30, 1954. 19p. Contract W-7405-eng-82. (ISC-480)

A description of apparatus for etching metallographic specimens by ionic bombardment in an electrical discharge tube and results obtained with the equipment are given. A drawing shows the construction of the apparatus and a circuit diagram gives information concerning the electrical power unit. Photomicrographs of brass and steel show that ionic bombardment gives no better results on these common metals than ordinary etching methods. However, photomicrographs of uranium, thorium, and two thorium alloys, indicate that bombardment has advantages for these metals. (auth)

4283

Knolls Atomic Power Lab.

EVALUATION OF FERRITIC SUBSTITUTES FOR THE AUSTENITIC STAINLESS STEELS. 1. RESISTANCE TO ATTACK BY SODIUM. E. G. Brush and R. F. Koenig. Apr. 22, 1954. 47p. Contract W-31-109-Eng-52. (KAPL-1103)

The ferritic chromium–iron alloys have several advantages which make them attractive substitutes for the austenitic stainless steels in sodium-cooled nuclear power plants where primary coolant temperatures will not exceed 1000°F. The principal advantages are lower cost, greater availability, lower thermal expansion, and higher thermal conductivity. The resistance of the chromium–iron alloys to attack was evaluated in sodium at temperatures of 500 and 700°C in a series of static and dynamic laboratory tests. Results indicated that steels containing 12% chromium are as resistant to attack by solution and mass transfer in filtered sodium at 500°C as the austenitic stainless steels, do not decarburize in filtered sodium at 500°C, and are more susceptible to corrosion in sodium containing more than 0.01% by weight of oxygen at 500°C than the austenitic stainless steels. The results further indicated that the 12% chromium–iron alloy decarburized at a rate of 0.04 mil/hr in continuous immersion (2160 hr) in sodium containing 0.01% oxygen at 700°C, but did not decarburize in intermittent immersion in sodium at 649°C containing between 0.003 and 0.015% oxygen. Additional tests are in progress to determine the effects of stress and local oxide contamination on the corrosion of the chromium–iron alloys at 500°C in filtered sodium, to evaluate decarburization up to 800°C in sodium containing 0.003% oxygen, and finally to evaluate diffusion welding behavior. The operation of a large-scale 12% chromium–iron alloy heat transfer sodium system is desirable to substantiate laboratory data, which show the 12% chromium–iron alloy to have promise as a construction material for sodium service at temperatures up to 1000°F. (auth)

4284

Lewis Flight Propulsion Lab., NACA

A FURTHER INVESTIGATION OF THE EFFECT OF SURFACE FINISH ON FATIGUE PROPERTIES AT ELEVATED TEMPERATURES. Robert L. Ferguson. Jan. 4, 1954. 27p. (NACA-TN-3142)

An investigation was conducted to evaluate the effects of surface roughness on fatigue properties of low carbon N-155 alloy with a grain size of A.S.T.M. 6 and of S-816 alloy with a grain size of A.S.T.M. 6 to 7. Fatigue studies were conducted at 80, 1200, 1350, and 1500° F. In addition, an investigation of the effect of surface abrasion upon the character of residual stresses and of the effect of time and temperature upon the relief of these stresses was conducted. Compressive stresses were produced at right angles to the direction of abrasion. These residual compressive stresses, if of sufficient magnitude, in the surface of fatigue specimens improved fatigue strength at low temperatures. At elevated temperatures, however, these beneficial surface compressive effects were relieved, and only the detrimental stress concentration effects produced by abrasion remained and reduced fatigue strength. (NACA abst.)

4285

Armour Research Foundation

SOLID SOLUTION HARDENING OF ALPHA AND BETA TITANIUM. INTERIM TECHNICAL REPORT NO. 2 [FOR] DECEMBER 1, 1953 TO FEBRUARY 28, 1954. J. J. Rausch and D. J. McPherson. 17p. Contract DA-11-022-ORD-1439. (NP-5193)

Binary alloys of Al, B, C, Cr, Fe, Mn, Mo, N, O, Si, and V with high purity sponge Ti were studied to determine forging, rolling, heat treating, and quenching procedures to be used with large iodide Ti-base ingots. The compositions which were found to be suitable for studies of α and β phase hardening are indicated. (A.G.W.)

4286

Massachusetts Inst. of Tech.

FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION. PROGRESS REPORT NO. 14. B. L. Averbach, M. Cohen, S. Allen, M. F. Comerford, and C. Houska. Mar. 31, 1954. 4p. Contract AT(30-1)-1002, Scope 3. (NYO-7070)

The changes that occur in metals during plastic deformation and subsequent annealing were studied by means of various x-ray techniques. A series of Au–Ag alloy filings were annealed at various temperatures up to 500°C. Complete recrystallization occurred at 350°C. Analysis of the diffraction peaks for the (220) and (440) line of Al and brass single crystals 50% deformed by rolling at room temperature is discussed. In brass, the local strain was about 10 times larger. The particle sizes for Al single crystals appeared to be of the order of 300 to 400 A in the (220) direction. (For preceding period see NYO-7069.) (J.A.G.)

4287
Aeroprojects, Inc.
INVESTIGATION OF THE DEGASSING EFFECT OF ULTRASONICS ON ALUMINUM ALLOY. J. Byron Jones and John G. Thomas. Feb. 1954. 60p. Contract AF-18-(600)-32. (WADC-TR-53-527)

An attempt was made to degas molten aluminum by causing gas to collect and rise to the surface from the nodes of sound waves introduced into a melt. The apparatus for effecting this phenomena was successfully built and demonstrated. In this work certain problems remain unanswered however, since the degassing was erratic and accompanied by serious contamination of the melt by erosion of the transducer coupler material. (auth)

4288
Battelle Memorial Inst.
THE WELDING CHARACTERISTICS OF SELECTED TITANIUM ALLOYS. SUMMARY REPORT [FOR THE PERIOD FEBRUARY 1, 1953 TO MARCH 31, 1954]. G. E. Faulkner, G. E. Martin, and C. B. Voldrich. Mar. 31, 1954. 53p. Contract DA-33-019-ORD-231. (WAL-401/97-29)

Series of titanium–aluminum alloys and titanium–vanadium alloys were prepared and tested. On the basis of the information obtained from these alloys and the binary chromium, iron, manganese, and molybdenum alloys studied last year, alloys were selected and studied which had promise of good strength and weld-joint properties. These selected alloys contained combinations of one beta-stabilizing element and aluminum, and combinations of two or more beta-stabilizing elements. The tests conducted on the base metals and welded joints consisted of base-metal tension tests and base-metal and weld-joint bend tests, notch-toughness tests, hardness studies, and microstructural examinations. (auth)

4289
Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM–ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT. FINAL TECHNICAL REPORT [FOR] SEPTEMBER 1, 1952 TO AUGUST 31, 1953. C. R. Lillie and H. D. Kessler. Jan. 1954. 108p. Contract DA-11-022-ORD-244. (WAL-401/103-29)

The best combination of mechanical properties was developed in the Ti–Al–V alloys. Ti–Al–Ta and Ti–Al–Nb alloys, heat treated to develop all-alpha structures, yield good properties, but are not feasible as long as tantalum and columbium are critical elements. Aluminum additions of as much as 6% did not produce a serious decrease in ductility of Ti–Al–V alloys. The effect of increasing aluminum content on the ductility of Ti–Al–Fe alloys was marked by the low ductility of all alloys containing more than 1% Fe. The strength level of Ti–Al–Fe and Ti–Al–V alloys is raised by additions of aluminum. Eutectoid formation in the Ti–Al–Fe system is accelerated by the addition of aluminum. Binary Ti–Al alloys develop moderate strengths and usable ductility for aluminum contents through 6%, but alloys containing 8% Al exhibit very poor ductility. For most compositions and heat treating conditions of Ti–Al alloys, the impact energy absorbed increases with increasing test temperature in the range of –40 to +100°C. In all systems in which β can be retained, heat treating characteristics are a function of the amount of β retained by the alloying element (Fe, Cr, V, Mo). Alloys in which little or no β is retained attain maximum strengths on water quenching; those containing intermediate amounts of retained β are hardenable both by quenching and by aging; and alloys containing large amounts of retained β are age hardenable only. Age hardening at temperatures below 600°C was pronounced in Ti–Al–Fe alloys containing 3% and 5% Fe and in Ti–Al–V alloys containing 6% and 12% V, indicating retention of β on quenching. Brine-quenching of Ti–Al–Fe and Ti–Al–V alloys resulted in properties nearly identical with those resulting from water quenching; it is thus indicated that if aging on water quenching occurs in certain of these alloys, it is not suppressed by the rapid brine quench. (For preceding report in series see WAL-401/103-27.) (auth)

4290
Engineering Research Inst., Univ. of Mich.
HIGH-RESOLUTION AUTORADIOGRAPHY FOR STUDY OF GRAIN BOUNDARIES IN METALS. FINAL REPORT. H. J. Gomberg, M. J. Sinnott, C. Upthegrove, R. A. Flinn, L. H. Van Vlack, S. Yukawa, A. S. Keh, H. B. Probst, R. Simonsen, G. C. Towe, and C. M. Hammond. Feb. 1954. 83p. Contract DA-20-018-ORD-12150. (WAL-843/13-19)

Results obtained from experimental work directed toward improvements in the techniques of high-resolution autoradiography, and application of the autoradiographic techniques in studies of metallurgical problems are presented. Of the several available methods of high-resolution autoradiography, the stripping-film method was the simplest and most consistent in execution and results. Recommended procedures for sample preparation, application of plastic protective coating, application of the stripping film, exposure conditions, and processing of the autoradiographs are given. One of the most troublesome difficulties of stripping-film autoradiography, namely peeling, buckling, and shifting of the emulsion during exposure and processing, was practically eliminated by the addition of a wetting agent to the water used during the application operation. The radioactive characteristics of isotopes desirable for high-resolution autoradiography and factors that should be considered in the interpretation of autoradiographs are discussed. The types of metallurgical problems studied using the autoradiographic technique in order to evaluate its usefulness as a metallurgical research tool were: diffusion of nickel into iron, distribution of sulfides in iron, distribution of bismuth in copper, diffusion of liquid bismuth into copper, diffusion of nickel into copper, distribution of hydrogen (tritium) in copper-tin alloys, and distribution of sulfur in cast iron with spherulitic graphite. A description of procedures and equipment used for the introduction of the radioactive isotopes and the subsequent steps of heat treatment, sample preparation, etc., is given for each of these systems. The value of high-resolution autoradiography as a metallurgical research tool is demonstrated by the results obtained. Some new information about these metallic systems, as well as substantiation of known facts, were obtained. Autoradiographs showing the diffusion of nickel along grain boundaries or iron in both the gamma and alpha-phase regions and some quantitative data for the extent of this diffusion are given. Autoradiographic identification and differentiation of sulfides in iron is shown, as well as a quantitative estimate of the width of a submicroscopic film of sulfide, if it exists. The autoradiographic pattern of bismuth distribution in copper is correlated with the subgrain structure, and the absence of any change in this distribution with subsequent metallurgical operations is noted. The influence of relative crystal orientation on the extent of grain-boundary diffusion of both bismuth and nickel into copper has been studied using autoradiographs to aid in identifying the diffusion material in the grain boundaries. Microstructural and autoradiographic evidence of tritium absorption by copper–tin alloys during melting indicates that tritium, and presumably ordinary hydrogen, is generally distributed in a very loosely bound state in this alloy. No conclusive evidence was found regarding the distribution of sulfur in cast irons. (auth)

4291
IMPREGNATION OF STEEL WITH TITANIUM IN A MIXTURE OF MOLTEN SODIUM CARBONATE AND TITANIUM DIOXIDE. S. Kowal. Translated from Prace Inst. Mechan. (Warsaw), No. 6, 5-12(1953). 14p. Available from Henry Brutcher (Trans. No. 3152), Altadena, Calif. (AEC-tr-1896)

4292
FACING OF STEEL WITH BRONZE BY USE OF THE ELECTRIC ARC. V. A. Ivanov, A. V. Shardin, and P. I. Shorin. Translated from Avtogennoe Delo 18, 28(1947). 6p. Available from Henry Brutcher (Trans. No. 2086), Altadena, Calif. (AEC-tr-1904)

4293
ON THE PROBLEM OF PRODUCING METALLIC TITANIUM BY ELECTROLYSIS OF MOLTEN BATHS. S. I. Sklyarenko and Ya. M. Lipkes. Translated by E. R. Hope from Zhur. Priklad. Khim. 13, 51-5(1940). 9p. (AEC-tr-1906)

Experiments on the electrolysis of TiO_2 dissolved in molten salt baths of $Na_4P_2O_7$ + NaCl, $CaCl_2$, $CaCl_2$ + NaCl, and cryolite, and on the electrolysis of K_2TiF_6 dissolved in a mixture of molten Na and KCl are reported. In all cases a mixture of the lower oxides, not metallic Ti, was deposited on the cathode. In some cases however, the lower oxides apparently contained a certain quantity of the metal. (J.A.G.)

4294
TESTING OF THE INDUCTIVE MAGNETIC TEST APPARATUS "DUROKAWIMETER" DESIGNED BY DR. FORSTER. H. Mäder. Translated by I. A. Warheit from Aluminium 26, 10-13(1944). 8p. (AEC-tr-1916)

Alloy tests with a magnetic induction apparatus previously described (Aluminium 25, 130-3(1943)) are reported. The device was used for differentiation between alloys, hardness testing, and related studies pertinent to the investigation of alloy physical properties. (K.S.)

4295
THE CALCULATION OF DIFFUSION COEFFICIENTS IN CASES OF SINGLE-PHASE AND MULTIPLE-PHASE DIFFUSION IN SOLID ALLOYS. Theo Heumann. Translated from Z. physik. Chem. 201, 168-89(1952). 15p. (AERE-Trans-11/3/5/399)

4296
THE RESULT OF DIFFUSION PROCESSES IN ARTIFICIAL MIXED CRYSTALS. Theo Heumann and Alfons Kottmann. Translated from Z. Metallkunde 44, 139-54(1953). 26p. (AERE-Trans-11/3/5/400)

4297
PROPERTIES OF PLUTONIUM METAL. Cyril Stanley Smith (Univ. of Chicago, Ill.). Phys. Rev. 94, 1068-9(1954) May 15.

Recently declassified data on the physical properties of Pu metal are given. At least five allotropic modifications are shown to exist at atmospheric pressure. A 23% change in atomic volume accompanies a transition from the α to δ phase, the latter possessing a f.c.c. structure with negative expansion coefficient. The temperature coefficient of resistivity of the α phase is negative, and thermal expansivity very high. (K.S.)

4298
PRODUCTION AND PROPERTIES OF HIGH-PURITY NICKEL POWDER. F. A. Forward (Univ. of British Columbia, Vancouver, Canada). Bull. Inst. Metals 2, 113-16(1954) May.

A description is given of a new process that has been developed to produce high-purity nickel powder from a Canadian ore. The process consists of a combined ammonia-leaching and hydrogen-reduction operation, which is outlined. By this means nickel powders can be produced to meet a wide variety of particle-size specifications. Possible uses are indicated. (auth)

4299
A REDETERMINATION AND INTERPRETATION OF THE TITANIUM-RICH REGION OF THE TITANIUM-CHROMIUM SYSTEM. M. K. McQuillan (Imperial Chemical Industries, Ltd., Birmingham, England). J. Inst. Metals 82, 433-9(1954) May.

Conflicting evidence in the literature has led to a redetermination of the phase boundaries in the composition range 0–14 at. % chromium, using techniques designed to eliminate all likely sources of error. The results differ from those previously obtained by micrographic methods, and agree with those obtained in the range 0–4 at. % chromium by the hydrogen-pressure method. The eutectoid temperature has been found to be much lower than hitherto supposed. The difference between the present and previous micrographic results has been found to be due to insufficiently rapid quenching in the earlier experiments. A new interpretation of the behavior of titanium alloys, based on the postulate of the aggregation of like atoms in the β solid solution, has been put forward, and a reason for this behavior, in terms of a change with temperature in the electronic structure of the titanium atom, is suggested. It is believed that similar considerations may apply in other titanium alloy systems. (auth)

4300
SOME FURTHER OBSERVATIONS ON THE FATIGUE PROCESS IN PURE ALUMINIUM. P. J. E. Forsyth (Royal Aircraft Establishment, Farnborough, England). J. Inst. Metals 82, 449-55(1954) May.

The fatigue process in pure aluminium has been more fully studied with special reference to the mechanism of slip under cyclic stresses. The similarities and differences of deformation produced by cyclic and static stressing have been investigated both microscopically and by the multiple-beam interference technique. The effect of cyclic stressing at a higher frequency has been investigated, and it is concluded that cyclic stressing may produce a considerable rise in temperature in the region of slip bands, which become more localized at higher frequencies. (auth)

4301
THE SYSTEM URANIUM-MERCURY. B. R. T. Frost (Atomic Energy Research Establishment, Harwell, Berks (England)). J. Inst. Metals 82, 456-62(1954) May.

The uranium-mercury alloy system has been examined over the whole composition range from −40 to 1000°C, by means of x-ray, thermal, and low-temperature micrographical analysis. The high volatility of mercury necessitated the development of a method of preparation of the alloys at relatively low temperatures by the use of pyrophoric uranium. Three types of thermal-analysis apparatus were used to suit the varying conditions over the 1100°C temperature range. At all except very dilute concentrations the alloys were pyrophoric, and all operations had to be carried out in vacuo. The solid solubility of uranium in mercury and that of mercury in uranium are both very small. The addition of mercury to uranium has no detectable effect on the transformation temperatures of uranium. Three intermetallic compounds, with the formulae UHg_2, UHg_3, and UHg_4, have been identified, and the crystal structures of UHg_2 and UHg_3 have been confirmed. From a consideration of these structures and of the melting points of the compounds, it is concluded that the high electrochemical factor between mercury and uranium is not operating with its maximum effect in the compounds. (auth)

4302
A GRAPHICAL METHOD FOR RAPID ESTIMATION OF THE THICKNESS OF EVAPORATED METAL FILMS. K. P.

Nandy (Inst. of Nuclear Physics, Calcutta, India). Rev. Sci. Instr. 25, 523-4(1954) May

A graphical method for rapid estimation of film thickness under different evaporating conditions is proposed. The graphs, being on a linear scale, are somewhat more accurate than logarithmic scales. (L.T.W.)

4303

A SURVEY OF THE LITERATURE ON THE EXTRACTIVE METALLURGY AND ELECTROLYTIC REFINING OF BISMUTH. P. M. Gruzenski and W. J. Crawford (Bureau of Mines, Albany, Oreg.). U. S. Bur. Mines Inform. Cir. 7681, 1-12(1954) May.

A survey of the literature on the extraction of Bi from raw materials, its separation from Pb, and its subsequent refining is presented. The use of aqueous, nonaqueous, and fused electrolytes in electrolytic refining is reviewed. (auth)

4304

FRICTION OF CLEAN METALS AND OXIDES WITH SPECIAL REFERENCE TO TITANIUM. E. S. Machlin and W. R. Yankee (Columbia Univ., New York). J. Appl. Phys. 25, 576-81(1954) May.

The friction coefficients of freshly cut sufaces in inert atmosphere are compared with values on the same surfaces later exposed to air. The kind of metal or oxide comprising the friction couple was also varied. From experimental data it was concluded that: (1) Solid-phase welding accounts for almost the entire magnitude of the static friction coefficient for metal–metal couples. (2) Fe–Ag does not solid-phase weld, other insoluble couples examined do weld. (3) A measure of solid-phase weldability appears to be the quotient of the work of adhesion and the shear strength of the weaker couple. (4) Titanium does not solid-phase weld to crystalline oxides to any greater extent than copper. (5) Freshly cut titanium solid-phase welds to other metals in frictional contact. The degree of welding is independent of the atmosphere (air, nitrogen, or argon) or the time (less than 24 hours) at room temperature in such atmospheres. This behavior is contrary to that experienced with iron or copper. With the latter couples less than five minutes exposure of a freshly cut surface to air is sufficient to markedly reduce the degree of solid-phase welding. (6) The seizability of titanium is probably due to the lack of resistance, of the contaminant film formed on it in air, and to penetration or wear in frictional contact. (auth)

PHYSICS

4305

Radiation Research Corp.

NUCLEAR BATTERIES. QUARTERLY PROGRESS REPORT NO. 3 [FOR] JANUARY 15, 1953–APRIL 15, 1953. J. H. Coleman. 39p. Contract DA-36-039-SC-42564. (AD-11130)

(For preceding period see AD-5680.)

4306

Radiation Research Corp.

NUCLEAR BATTERIES. QUARTERLY PROGRESS REPORT NO. 4 [FOR] APRIL 15, 1953–JULY 15, 1953. [J. H. Coleman]. 79p. Contract DA-36-039-SC-42564. (AD-16261)

(For preceding period see AD-11130.)

4307

Los Alamos Scientific Lab.

APPEARANCE POTENTIAL STUDIES. 2. NITROMETHANE. Richard J. Kandel. [1953]. 14p. Contract [W-7405-eng-36]. (AECU-2876)

Appearance potentials and excess kinetic energies were determined for the ions produced by the ionization and dissociation of nitromethane by electron impact in a mass spectrometer. Bond dissociation energies and mechanisms of fragmentation were deduced where possible. $D(CH_3\text{-}NO_2)$ has been found to be 2.56 v, a value in agreement with thermochemical data. The dissociation and ionization process yielding NO^+, the most abundant ion in the nitromethane mass spectrum, is believed to yield, at the same time, a CH_3O radical. A new value for the ionization potential of NO_2, 9.91 v, is reported. (auth)

4308

Knolls Atomic Power Lab.

TORUS ANALYSIS. R. L. Mathews and G. Horvay. Feb. 22, 1954. 37p. Contract W-31-109-eng-52. (KAPL-1072)

A 60-in.-diam. torus (a continuous hollow piston ring) is made of steel tubing with a $\frac{3}{8}$-in. tube diam. and a 10-mil wall thickness. It is used to restrict liquid-sodium flow in the rotating plugs assembly. A design problem arises. (a) What is the maximum radial compression of the continuous torus, by forces applied on the outside equator, which does not cause permanent deformations? (b) How does the deformation of a slit torus, restrained from shrinkage along the inner equator and squashed by forces applied on the outside equator, compare with the above? The possibility of buckling is to be ignored in these considerations. For simplicity of analysis, the continuous torus may be replaced in the calculations by an equivalent torus of square cross section. The answers so obtained are estimated to be reliable within 15%. For the slit torus, figures are given both for circular and for square cross section. The deflection values corresponding to a maximum stress of 30,000 psi indicate that the outside radius of the continuous torus can be compressed 25 mils without permanent deformation; this compares with the 3.3-mil compression of the slit circular tube. The method of analysis developed can be used equally well for redundant shell structures, such as two concentric cylindrical shells joined at the top and bottom by common flanges. In fact, the first application of the method pertained to such a structure and likewise concerned the rotating plugs assembly. (auth)

4309

Laboratories for Research and Development, Franklin Inst.

STUDY OF RECTIFYING CONTACTS BETWEEN SEMICONDUCTORS. QUARTERLY PROGRESS REPORT [FOR] DECEMBER 31, 1953 TO MARCH 31, 1954. Daniel P. Detwiler. 14p. Contract AF 18(600)-465. (NP-5171; P-2337-6)

The electric conductivity of GaSb was investigated in connection with research on the properties of semiconducting intermetallic compounds. (K.S.)

4310

Solid-State and Molecular Theory Group, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT NO. 12. Apr. 15, 1954. 43p. Contract N5ori-07856. (NP-5172)

Theoretical investigations described in the previous report have continued in the field of perturbed periodic potentials. Additional calculations on a simplified tight-binding approximation for a body-centered cubic structure are reported. Studies on the energy bands in Cu by the augmented plane-wave method, and Cr by a calculation of matrix elements and orthogonalized plane waves, are reported. The transition probability for x-ray emission in

transition metals from 3d to 3p and 4s to 3p was calculated as 3.48. An investigation has been made of the energy bands in graphite by a tight-binding calculation. An approximate expression for the coefficients involved in a simple impurity calculation, described in the previous report, was found to give close agreement with the more accurate expression. An approximation to the atomic wave functions for Fe, where exchange effects are considered, has been undertaken by setting up a single determinant of one-electron functions. A systematized procedure is described for using a digital computer to calculate matrix elements in terms of quantities defined over the atomic orbitals. All 2-electron integrals of $1/r_{12}$, between symmetry orbitals, of the forms (NN|NN), (NN|NH), and (HH|HH) have been evaluated for the observed internuclear separations. N represents a nitrogen wave function and H a hydrogen wave function. The two functions to the left of the vertical bar form the charge density of electron 1 and those to the right of the bar that for electron 2. (For preceding period see NP-5114). (K.S.)

4311

Solid-State and Molecular Theory Group, Mass. Inst. of Tech.

ELECTRONIC STRUCTURE OF SOLIDS. 3. CONFIGURATION INTERACTION IN SOLIDS. John C. Slater. Apr. 15, 1954. 114p. Contract N5ori-07856, Technical Report No. 6. (NP-5174)

A series of papers on the electronic structure of atoms, molecules, and solids is concluded by a treatment of the configuration interaction in solids. Problems associated with the configuration interaction between many determinantal wave functions are dealt with in relation to that linear combination of determinants which best represents an acceptable approximation to a solution. (K.S.)

4312

Research Lab. of Electronics, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT [NO. 33 FOR THE PERIOD ENDING FEBRUARY 28, 1954]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Apr. 15, 1954. 111p. Contract DA-36-039-sc-100. (NP-5181)

Preliminary performance characteristics have been obtained for the omegatron, an electron tube to be used in the investigation of vacuum problems. Dielectric and impendance resonances in microwave gaseous discharges are theoretically treated in terms of pressure and density distributions. The microwave cavity and probe assembly previously described were used to study the low-pressure behavior of the positive-ion saturation current in H_2 and He. The continuous-wave microwave breakdown in pure H_2 was found to show no serious departures from theoretical predictions. Preliminary results on the dielectric constant of SiC at 77°K yield a value of 7. The design of an improved liquid-He viscometer is described, and data are presented on the second-sound pulse amplitudes in He II as a function of power input in the temperature range of 1.4 to 0.9°K. Microwave spectrum investigations are reported for O_2, OCS, CH_3SiH_3, HDO, and D_2O. Isotope-shift effects in Hg^{196} and Hg^{197}, self-reversal of Na resonance radiation, and the Zeeman spectra of Hg ($\lambda = 4047$) were studied. Further developments in the theory of noise in electron beams and the performance characteristics of internally coated cathodes are described. Graphical results from FM receiver design tests on the effect of limiter and discriminator bandwidths on interference rejection are given. Investigations on information and statistical communication theory have been carried on from results of the previous quarter. Variational theory for the resonant frequencies of complex microwave components, partially or completely filled with ferrite, is developed as an extension of previous work on simpler systems. Topics in speech analysis and communications biophysics are discussed. Procedures for applying signal flow-graph transformations to analog computers are briefly outlined. A driving-point impedance analysis of the effect of adding a single inductance to some point in an RC driving-point impedance network showed that such an impedance will have at most one pair of complex conjugate zeros and poles. Theoretical considerations arising from problems in network synthesis are treated. (For preceding period see NP-5115.) (K.S.)

4313

Royal Aircraft Establishment, Farnborough, Hants (England)

SELECTED LIST OF PUBLISHED REFERENCES TO TRANSISTORS AND SEMICONDUCTORS. R. H. Forrest. June 1953. 11p. (RAE-LIB-BIB-93; AD-18767)

This bibliography contains 111 references organized according to the following sources: Aeronaut. Eng. Rev., Bell Labs. Record, Bell System Tech. J., Brit. J. Phy., Phys. Rev., Proc. I.R.E., Elec. Eng. (N. Y.), Electronics, Electronic Eng., Proc. I.E.E. (Pt. III), RCA Rev., G.E.C.J., Gen. Elec. Rev., Research, Proc. of the Phys. Soc. (Section A and Section B), Philips Tech. Rev., and J. Brit. Inst. Radio Engs. The most significant references are specially designated.

4314

MAGNETO-HYDRODYNAMIC WAVES IN LIQUID SODIUM. Bo Lehnert (Royal Institute of Technology, Stockholm, Sweden). Phys. Rev. 94, 815-24(1954) May 15.

Liquid sodium, because of its higher electrical conductivity and lower density, is more suitable than mercury for magneto-hydrodynamic experiments. Torsional waves in liquid sodium have been generated in a cylindrical vessel with the axis parallel to a homogeneous magnetic field, and resonance phenomena have been investigated at constant frequency and variable magnetic field strength. The agreement between theory and experiment is satisfactory. It is shown that even with sodium, damping plays an important role under laboratory conditions. The calculations of this paper are also used to improve the results of earlier investigations with mercury. (auth)

4315

SUPERFLUIDITY AND DISSIPATIVE PROCESSES IN LIQUID He II. J. G. Dash (Los Alamos Scientific Lab., New Mexico). Phys. Rev. 94, 825-8(1954) May 15.

A phenomenological theory of superfluidity of He II is constructed upon the two-fluid models of Tisza and Landau. The postulate that phonons partially represent the thermal energy of the liquid is employed to explain the dependence of critical velocities upon the size of the liquid region. A new assumption, of the production of phonons by the motion of large clusters of superfluid particles, provides a description of the transition between superflow and dissipation at flow velocities exceeding critical. (auth)

4316

COMPRESSION TO 10,000 ATMOS OF SOLID HYDROGEN AND DEUTERIUM AT 4.2°K. J. W. Stewart (Harvard Univ., Cambridge, Mass.) and C. A. Swenson (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 94, 1069-70(1954) May 15.

The relative volume change and compressibility of solid H_2 and D_2 at 4.2°K were experimentally determined at pressures up to 10,000 atmospheres. The volume of H_2 is reduced by 50% at the highest pressure, where the compressibility of H_2 and D_2 are equal. (K.S.)

4317

LEAD ISOTOPIC RATIOS AND GEOLOGIC TIME. Paul E. Damon (Univ. of Arkansas, Fayetteville). Am. Geophys. Union Trans. 34, 906-14(1953) Dec.

The consistency of recent data with Nier's data and with the Nier-Holmes hypothesis for the isotopic abundance of common lead ores is examined. It can be shown that, although individual samples deviate markedly from expectation according to age alone, the data taken together are in agreement with the basic hypothesis. The deviations tend to be non-random. Possible causes of these deviations are discussed. One consequence of the Nier-Holmes hypothesis is that the lead ores should have been derived from the granitic rocks of the Earth's crust rather than from a deep-seated source. The study of lead isotopic ratios may be applied to geologic problems other than that of geologic time. (auth)

4318

A NEW SEMI-AUTOMATIC APPARATUS FOR MEASUREMENT OF SPECIFIC HEATS AND THE SPECIFIC HEAT OF SODIUM BETWEEN 55 AND 315°K. T. M. Dauphinee, D. K. C. MacDonald, and H. Preston-Thomas (National Research Council, Ottawa, Canada). Proc. Roy. Soc. (London) A221, 267-76(1954) Jan. 21.

An apparatus has been developed for the semi-automatic measurement of specific heats from room temperature to the liquid-hydrogen range. A dynamic system, involving continuous heat input to the sample, is made possible by the use of a relatively small sample together with a large effective surface area for the heaters. Adiabatic conditions can then be maintained automatically. All data relevant to the specific heat determination (time, power input, and temperature) are recorded on a single chart. The operator is required only for periodic switching, which could in principle also be automatic. The specific heat of sodium has been studied between 55 and 315°K with this apparatus. The predicted limits of accuracy (±0.1%) appear to be approached rather closely. A small anomaly, showing some hysteresis effects, appears in the region of 200°K. (auth)

4319

ON THE BOSE-EINSTEIN LIQUID MODEL FOR LIQUID HELIUM. I. He^3-He^4 MIXTURES. Ziro Mikura (Tohoku Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 25-52 (1954) Jan.

A theory of He^3-He^4 mixtures is developed, in which He^3 is represented by a nondegenerate Fermi gas in a potential well, and He^4 by an assembly of Bose-particles in another potential well, each Bose particle being considered to have a much larger mass than a He^4 atom and to have an energy gap between the ground state and the lowest excited state. Agreement between theory and experiment concerning the transition temperature and the vapor pressure in solution is satisfactory, if the energy of excitation is assumed to be proportional to the number density of He^4 "particles" in solution. The increase of the velocity of second sound in solution can be accounted for based on this theory under the condition that He^3 particles partake in the motion of the normal part particles, in contrast to Koide and Usui's conclusion. The osmotic pressure, the thermomechanical effect, and the specific heat in solution are also discussed. It is also remarked that the analogue, in solution, of Mendelssohn and Chandrasekhar's experiment would offer the most definite answer to the question which of the two theories is more tenable, de Boer and Gorter's or the present author's. Second sound for dilute solutions near the absolute zero of temperature is also discussed, and it is concluded that the square of the velocity should be there proportional to T and the proportionality coefficient is roughly equal to R/3. Theory and experiment are in general agreement also in this case. (auth)

4320

ON THE DISSOCIATION ENERGY OF GASEOUS NICKEL OXIDE NiO. L. Huldt and A. Lagerqvist (Univ. of Stockholm, Germany). Z. Naturforsch. 9a, 358-9(1954) Apr. (In German)

The stability of the gaseous NiO was investigated by means of the flame method. The dissociation energy was too low to permit an accurate determination. An upper limit on the dissociation energy is $D_{NiO} < 4.2$ ev. (tr-auth)

4321

STORAGE AND TRANSFER OF LIQUID HELIUM. Aaron Wexler (Westinghouse Research Labs., East Pittsburgh, Penna.). Rev. Sci. Instr. 25, 442-5(1954) May.

The performance of large, efficient storage containers for liquid helium is indicated, and liquid helium transfer techniques permitting correspondingly efficient use of the stored liquid are described. (auth)

4322

MEASUREMENT OF TWO-DIMENSIONAL FIELDS. PART I. THEORY. W. C. Elmore and M. W. Garrett (Swarthmore Coll., Penna.). Rev. Sci. Instr. 25, 480-5(1954) May.

An arbitrary two-dimensional magnetic field may be uniquely specified by listing all coefficients of the power-series expansion of its complex potential function. An experimental procedure is described in which the first N coefficients are derived from an N-point harmonic analysis of the radial component of field or gradient, as measured with a dipole or quadrupole search coil at N equally spaced angular positions about an arbitrary longitudinal axis. The method may be refined by mounting two coils coaxially on a radial arm, so connected as to balance out the strongest component present and permit more accurate determination of the higher harmonics. With four coils, odd or even harmonics also may be suppressed. Analysis of the symmetry of various magnet pole structures shows that many of the coefficients vanish identically. Procedures are outlined for measuring with a quadrupole search coil the five independent elements of the magnetic gradient dyadic at a point in an unrestricted field. It is shown that in the fringing region at the ends of a long magnet gap the axial average of the transverse field can be treated as a two-dimensional field. It is correctly measured using line dipole or quadrupole search coils, whose design is prescribed. The procedure is identical with that for the two-dimensional case. A further extension of the same method to measurements made with the electrolytic tray analog increases greatly their speed and accuracy. (auth)

4323

THE MEASUREMENT OF TWO-DIMENSIONAL FIELDS. PART II. STUDY OF A QUADRUPOLE MAGNET. I. E. Dayton, F. C. Shoemaker, and R. F. Mozley (Princeton Univ., N. J.). Rev. Sci. Instr. 25, 385-9(1954) May.

The characteristics of a d-c quadrupole magnet have been measured using some of the techniques for measuring two-dimensional fields and gradients proposed by W. C. Elmore and M. W. Garrett in the preceding paper. Saturation curves and measurements of the flux distribution in the magnet are presented. The characteristics of the magnet have been determined both in the interior and in the fringing region at each end. It is shown that by using a pole tip of circular cross section and correctly chosen radius it is possible to produce a magnetic field with gradient constant to ± 1 percent out to 0.8 of the radius of the gap. (auth)

4324

DILUTION OF POWDER SAMPLES FOR X-RAY DIFFRACTION. Edmunds M. Pogainis and Edwin H. Shaw, Jr. (Univ. of South Dakota, Vermillion). Rev. Sci. Instr. 25, 524(1954) May.

A number of possible diluents for use with Cu K α radiation were tried out. Of the various diluents tested (lampblack, wheat flour, gum tragacanth, charcoal, gum arabic, and casein), lampblack proved to be superior to all others. (L.T.W.)

4325

NEW EFFECTS IN NUCLEAR QUADRUPOLE RESONANCE. Jules Duchesne and André Monfils. Compt. rend. 238, 1801-3(1954) May 3. (In French).

In a series of mixed crystals of p-dichlorobenzene and p-dibromobenzene the intensity of the resonance ray at 34.282 Mc was studied as a function of the p-dibromobenzene concentration. With increasing concentration of the bromo salt, the intensity decreased rapidly. The kinetics of the phase transformation of p-dichlorobenzene at 21°C was followed by a constant examination of the resonance rays of the two phases. (J.S.R.)

4326

A WAVE GUIDE WITH HELIX FOR THE ACCELERATION OF PROTONS FROM 1 MEV to 10 MEV. R. Servranckx. Bull. Classe Sci. Acad. 40, 167-78(1954) Feb. (In French)

The resolution of the Maxwell equations for a wave guide charged with a helix is presented. The geometric and electric characteristics of such a guide, utilized as an accelerator of protons, are calculated. The experimental verification was made for a single formula with satisfactory agreement. (tr-auth)

4327

THE ANISOTROPY OF THE MAGNETIC PROPERTIES OF POWDERED SAMPLES FROM THE ALLOY MnBi. E. V. Shtol'ts and Ya. S. Shur. Doklady Akad. Nauk S.S.S.R. 95, 781-4(1954) Apr. 1. (In Russian)

The magnetizability and the coercive intensity were measured at −195 and + 20°C for a powdered Mn−Bi alloy containing 30 vol. % of the ferromagnetic phase. These properties were determined as a function of the grain texture and particle size. (J.S.R.)

4328

THE HEATS OF FORMATION OF METAL HALIDES. ALUMINIUM FLUORIDE. P. Gross, C. Hayman, and D. L. Levi (Fulmer Research Inst. Ltd., Stoke Poges, Buckinghamshire, England). Trans. Faraday Soc. 50, 477-80(1954) May.

The heat of the reaction $\frac{3}{2}\ PbF_2 + Al = AlF_3 + \frac{3}{2}\ Pb$ has been measured calorimetrically, the reactants being in powder form. The heat of reaction is -117.9 ± 0.1 kcal/mole from which, with the value of −158.5 kcal/mole for the heat of formation of lead fluoride, the value of −355.7 kcal/mole for the heat of formation of aluminum fluoride is derived. The value is used to correct the heat of formation of aluminum monofluoride vapor, which is −59.2 kcal/mole. Some measurements were also carried out on the reaction between lead fluoride and magnesium. (auth)

4329

THE STORAGE OF ENERGY IN SOME ACTIVATED ALKALI HALIDE PHOSPHORS. H. O. Albrecht and C. E. Mandeville (Franklin Inst., Swarthmore, Penna.). J. Franklin Inst. 257, 353-68(1954) May.

The phosphorescent emission of thallium activated NaCl and KCl has been investigated at 25°C, using as primary excitants alpha particles and ultraviolet light. The energy storage properties of x-ray-irradiated NaCl-Tl, KCl-Tl, NaCl-Ag, and KCl-Ag have been compared, and the photostimulated ultraviolet emission of NaCl-Ag has been determined as a function of the silver concentration. Some dosimetric aspects of the data are discussed. (auth)

4330

PRESSURE EFFECTS IN PHOSPHORESCENCE. L. Reiffel (Illinois Inst. of Tech., Chicago). Phys. Rev. 94, 856(1954) May 15.

The influence of hydrostatic stress on the phosphorescence decay of thallium-activated sodium iodide is shown to be very marked. Pressures as low as 100 kilograms per square centimeter produce readily observable effects. Interpretation in terms of pressure-increased effective trap depth is given. (auth)

COSMIC RADIATION

4331

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

AN ANALYSIS OF THE MESON COMPONENT OF COSMIC RAYS IN THE ATMOSPHERE. Stanislaw Olbert. Apr. 1, 1954. Contract N5ori-07806, Technical Report No. 61. (NP-5177)

The meson component of cosmic rays in the atmosphere is investigated quantitatively with respect to its various fundamental characteristics. The analysis is based on a unidimensional equation for the vertical differential intensity of μ mesons, studied originally by M. Sands. The following topics are discussed in detail: (1) The a priori unknown range spectrum of μ mesons at production, G(R′), is derived from Sands' equation with the aid of recent experimental data concerning the μ-meson intensity. These include the altitude and latitude dependence of μ-meson intensities as well as the momentum distribution of μ mesons at sea level. It is shown that, for the residual ranges 100 g cm^{-2} < R′< 6,000 g/cm^2, the production spectrum may be represented by the empirical formula $G(R') = 7.31 \times 10^4/(a+R')^{3.58}$ [cm^2/g^2/sec/sterad], where a is a constant characteristic for a given geomagnetic latitude. The values of a vary from 646 g/cm^2 at the geomagnetic equator to 513 g/cm^2 at 60° geomagnetic latitude. The value of 520 g/cm^2 at 50° geomagnetic latitude is considered as the most reliable, since at this latitude the experimental data are most complete. The production spectrum is compared with that derived by M. Sands on the basis of earlier, less accurate observational material. (2) The effects of atmospheric temperature and pressure on the μ-meson intensity are studied for locations near sea level. The treatment is rigorous in the sense that it includes the continuous production as well as the ionization losses of μ mesons in the atmosphere. With the help of the newly obtained production spectrum and the exact expression for the survival probability of μ mesons, a three-term regression formula for the relative changes of μ-meson intensity is derived and discussed in detail. According to this formula, the relative intensity changes are to be correlated not only with the average production height and the ground pressure (a customarily employed two-term correlation) but also with the average tropospheric temperature. This additional correlation, resulting from the ionization losses of μ mesons in the air, indicates a possibility of removing some apparent difficulties in the interpretation of experimental data (as, for example, the discrepancies found in the decay coefficients determined from diurnal and seasonal observations, respectively). (3) The differential energy spectra of π mesons at production are computed for various geomagnetic latitudes, whereas use is made of the latitude dependence of the production spectrum of μ mesons. The obtained latitude dependence of the π-meson spectra is linked with the geomagnetic effect on the primary cosmic radiation. Some crude conclusions regarding the multiplicity problem of π-meson production are drawn in a preliminary manner. (auth)

4332
CASCADE PROCESSES IN WIDE ATMOSPHERIC SHOWERS OF COSMIC RAYS. I. L. Rozental'. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 440-55(1952). 17p. (AERE-Trans-11/3/5/391)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-3758.

4333
FOUR τ-MESONS OBSERVED ON KILIMANJARO. K. R. Dixit (Institute of Science, Bombay, India). Z. Naturforsch. 9a, 355-7(1954) Apr. (In English)

Four τ-meson-events observed on the top of Mount Kilimanjaro are described. Two of them definitely show that a τ-meson can disintegrate into two π-mesons and one μ-meson. The third event also indicates the same possibility, whereas no definite conclusion whatever can be drawn from the fourth event. The mean mass of the τ-meson comes out as 959 ± 10 electron masses. (auth)

4334
STUDIES ON THE STOCHASTIC PROBLEM OF ELECTRON-PHOTON CASCADES. Alladi Ramakrishnan and P. M. Mathews (Univ. of Madras, India). Progr. Theoret. Phys. (Japan) 11, 95-117(1954) Jan.

A brief review of the well-known fluctuation problem of cosmic radiation is given in a proper historical setting. Latest numerical calculations for the second moments of the electron distribution are presented as a sequel to those of Bhabha and Chakrabarthy for the mean number. (auth)

4335
COSMIC RADIATION INTENSITY-TIME VARIATIONS AND THEIR ORIGIN. IV. INCREASES ASSOCIATED WITH SOLAR FLARES. John Firor (Univ. of Chicago, Ill.). Phys. Rev. 94, 1017-28(1954) May 15. (Cf. NSA 7-4159, 7-4838.)

The distribution on the earth of the impact points for particles of magnetic rigidities 1 to 10 Bv, which originally approach the earth from the direction of the sun, is derived, using principally the published results of numerical integrations of cosmic-ray orbits and model experiments on the motion of charged particles in a dipole magnetic field. Three impact zones for such particles are discussed. Two of these zones include only a small range of local times, and for the special case of the sun in the plane of the geomagnetic equator, are centered near 4 A.M. and 9 A.M. The third zone has no strong local time dependence. Assuming the source of charged particles to subtend a finite angle at the earth, the relative counting rates for detectors in the three zones are estimated. The counting rate due to particles from the sun is expected to be three to seven times larger in the morning zones than in the background, or non-local-time-dependent, zone. The morning impact zones are shown to have a seasonal motion of several hours in local time. Reports of observations made during four large increases of cosmic-ray intensity at the times of solar flares are compared with the distribution predicted for particles from the sun. The observed increases agree with the predicted distribution and counting rate except at very high latitudes on the earth. A possible reason for this discrepancy is suggested. Cosmic-ray data from the Climax neutron detectors are analyzed for possible increases associated with small solar flares. An increase of ≈1 percent is found for flares occurring when the detector is in a morning impact zone for particles from the sun. No increase of more than ≈0.3 percent is found for flares occurring when the detector is not in these zones. The mean daily cycle of cosmic-ray intensity is also shown to depend on the rate of flares occurring on the sun. The intensity curve is peaked during the early morning hours for flare periods relative to periods in which few or no flares occurred, in agreement with the supposition that new particles approach the earth from the direction of the sun at the times of flares. (auth)

4336
SOLAR MAGNETIC MOMENT AND COSMIC-RAY EFFECTS ASSOCIATED WITH SOLAR FLARES. S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 94, 1029-30(1954) May 15.

A close correlation between solar flares and small cosmic-ray intensity increases has recently been established by the Climax, Colorado, neutron monitor data. The correlation, however, is restricted only to those flares which occur when the station lies within a certain interval of local solar time. This has been explained by supposing that the new cosmic-ray particles approach the earth preferentially along the earth-sun line, before deflection in the terrestrial magnetic field takes place. In the present paper, this evidence is used to establish an upper limit to a possible solar magnetic dipole field. Allowance is made for the fact that the dipole field may be seriously perturbed by local fields near the sun; but on the assumption that the dipole field predominates far from the sun (at distances greater than one-fifth the earth-sun distance), the upper limit on the solar dipole moment is 5×10^{32} gauss-cm^3. (auth)

4337
COSMIC RADIATION INTENSITY-TIME VARIATIONS AND THEIR ORIGIN. V. THE DAILY VARIATION OF INTENSITY. J. W. Firor, W. H. Fonger, and J. A. Simpson (Univ. of Chicago, Ill.). Phys. Rev. 94, 1031-6(1954) May 15. (Cf. NSA 7-4159, 7-4838.)

Properties of the 24-hour intensity variations which were established by ion chamber and counter telescope measurements at high primary-particle energies have now been extended to the low-energy portion of the primary spectrum by measurements with high-altitude neutron piles at geomagnetic latitudes 0° and 48°. The observations demonstrate that the peak-to-peak amplitude of the 24-hour variation increases with latitude and, hence, is dependent on primary-particle rigidity. The latitude ratio for the peak-to-peak variation is ~1.4 ± 0.2 and the amplitude at 48° is of the order 1 percent. These facts preclude primary neutrons or a general solar dipole field as the origin of this intensity variation. It is shown that although the amplitude of the variation changes from day to day, the amplitudes of the intensity variations of particles at low and high energy are related. It is further shown that the amplitude on one day persists for only the next 1 or 2 days and that there is not a strong 27-day recurrence tendency. The general features of the changes in peak-to-peak amplitudes of the monthly average 24-hour variations appear in both neutron detectors and in the Freiburg ionization chamber. Arguments based on the experimental observations are presented to exclude meteorological factors, the terrestrial magnetic field variations, and simple geoelectric field accelerations as the origin of the variation. Since it is shown that the particles which produce the 24-hour variation are charged and have their highest intensity near or after noon local time, it does not appear probable that they come from the direction of the sun. Although it is doubtful that this variation is of terrestrial origin, no proof has yet been given that the variation is of extraterrestrial origin. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4338
Ames Lab.
HIGH TEMPERATURE CRYSTAL STRUCTURE OF THORIUM. Premo Chiotti. [Apr. 30, 1954]. 15p. Contract [W-7405-eng-82]. (ISC-481)

High-temperature x-ray-diffraction patterns and electrical resistivity measurements show that thorium of 99.8%

purity transforms from face-centered cubic to body-centered cubic on heating to 1400±25°C. At 1450°C the lattice constant of body-centered cubic thorium is 4.11±0.01 A. The extrapolated lattice constant of face-centered cubic thorium at the same temperature is 5.180±0.005 A. The lattice constant of the metal used is 5.089±0.001 A at room temperature. The transformation temperature is rapidly increased as the amount of carbon in the metal is increased. Zirconium has the opposite effect in that small amounts of it are very effective in lowering the temperature at which the transformation begins. (auth)

4339

CROSS SECTION OF PULLED CRYSTALS. Robert G. Pohl (Rauland Corp., Chicago). J. Appl. Phys. 25, 668-9(1954) May.

An equation for the radius of a crystal grown by the Czochralski technique is derived by considering the mechanical and thermal equilibrium at the liquid-solid interface. The results agree qualitatively with experimentally known functional dependencies. (auth)

ELECTRICAL DISCHARGE

4340

A HIGH-CURRENT ARC OF VERY HIGH TEMPERATURE AND EXTREMELY LOW ARC VOLTAGE. G. Busz and W. Finkelnburg. Translated from Naturwissenschaften 40, 550-1(1953). 5p. (AEC-tr-1915)

ELECTRONS

4341

COMPONENTS OF THE IONIZATION CURRENT FROM GAMMA RAYS. I. V. Estulin. Translated by G. Belkov from Zhur. Eksptl'. i Teoret Fiz. 22, 414-20(1952). 12p. (TT-397)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-1191.

4342

MAGNETIC QUENCHING OF THE POSITRONIUM DECAY. Otto Halpern (American Express Company, Zurich, Switzerland). Phys. Rev. 94, 904-7(1954) May 15.

The influence of static and alternating magnetic fields on the radiative decay of positronium is investigated theoretically. Equations for the time variation of the probability amplitudes of the ortho- and para-states are presented and solved for various cases of experimental interest. In particular, formulas are derived which describe the resonance effects occurring in the case of a constant and a perpendicular alternating field. (auth)

4343

THE THREE-PHOTON ANNIHILATION OF POSITRONS AND ELECTRONS. S. DeBenedetti and R. T. Siegel (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 94, 955-9(1954) May 15.

The physical characteristics of the radiations emitted in the annihilation of positrons and electrons in the triplet state have been studied with a triple coincidence method. The energies of the three gamma rays, the angular distribution, and their polarization were found to agree with theory. Triplet annihilation was studied both from positrons stopping in gases where positronium was formed, and from positrons stopping in condensed materials. In the case of metallic absorbers, we verified within the accuracy of the experiment that the number of triplet annihilations is 1/370 of the number of singlet events. Experiments on the number of three-quantum annihilations in different materials are described. (auth)

4344

MEASUREMENTS OF ELECTRON PAIRS PRODUCED BY γ RADIATION AT 4550 m HEIGHTS (MONTE ROSA). K. Hintermann (Physikalisches Institut der Universität, Bern, Switzerland). Helv. Phys. Acta 27, 125-43(1954) May 1. (In German)

In a nuclear emulsion exposed to intense radiation at a 4550-m altitude, a part of the emulsion was systematically searched for pairs. Energy measurement and angle determinations between both tracks of a pair were made. The relationship between energy and angle corresponded within the limits of error with the Borsellino theory. From those measurements the photon spectrum and the spatial distribution were calculated. (J.S.R.)

INSTRUMENTS

4345

David Sarnoff Research Center

ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY REPORT NO. 14 [FOR] NOVEMBER 1, 1953–FEBRUARY 1, 1954. G. A. Morton, R. H. Anderson, D. H. Fetters, M. H. Greenblatt, A. L. Solomon, and A. H. Sommer. 18p. Contract W-7405-eng-26, Subcontract 308. (AECU-2883)

Data are presented from studies of activation processes and characteristics of multi-alkali Sb cathodes and the mechanism of photoelectric emission in completed cathodes; chemical analysis by micro-methods to determine the optimum ratio of the alkali metals in multi-alkali cathodes, and to determine the ratio of Sb to the total alkali metal content; x-ray-diffraction studies on the structure of the photoelectric Sb-alloys; and the design and performance of photomultipliers. (For preceding period see AECU-2795.) (C.H.)

4346

RF Components Lab., Air Force Cambridge Research Center

A WIDE-BAND SQUARE-LAW CIRCUIT ELEMENT. A. S. Soltes. Jan. 1954. 19p. (AFCRC-TR-54-2)

A square-law circuit element with operating frequency range from zero into the VHF region is described. Its dynamic range and accuracy capabilities vary with the particular conditions under which it is operated. Accuracies within less than 1% of full scale and output dynamic ranges of over 100 db have been achieved. Frequency response limitations and possible sources of error are analyzed. Experimentally determined characteristics are presented and noise properties, dynamic range, and accuracy potentialities evaluated. (auth)

4347

Carbide and Carbon Chemicals Co. (K-25)

AUTOMATIC-READING VISCOSIMETER. J. H. Junkins. May 26, 1954. 10p. Contract W-7405-eng-26. (K-1128)

An automatic-reading capillary-type viscosimeter constructed for measuring the relative viscosities of gases. The measurement of the viscosity is made in terms of the time required for the pressure exerted by a charge of gas in the capillary forechamber to decrease from one fixed value to a second fixed value while the gas flows through the capillary into a constant-pressure vessel. Computation of the absolute viscosity is based on the following relationship between the time t for gas A whose viscosity n is known, and the time for gas B whose viscosity is being determined: $t_{gas\ A}/n_{gas\ A} = t_{gas\ B}/n_{gas\ B}$. Pneumatic and electrical instruments are employed to (1) control the temperature of the bath in which the capillary is suspended, (2) maintain a constant pressure in the capillary exit vessel, and (3) actuate the timer which measures the interval corresponding to a given pressure drop in the capillary forechamber. The performance of these instruments is completely automatic, and primarily in this respect the apparatus described differs from manually operated expiration-type capillary viscosim-

eters. Small groups of consecutive measurements (e.g., five runs on dry nitrogen at 65.0°C.) yield readings which deviate from the mean value by the order of 7 parts in 10,000. (auth)

4348

X-Ray and Crystal Analysis Lab., Penna. State Univ.
A NEW TYPE OF GONIOMETER FOR SINGLE-CRYSTAL NEUTRON DIFFRACTION STUDIES. Ray Pepinsky. X-Ray and Crystal Analysis Lab., Penna. State Univ. and Brookhaven National Lab. Sept. 1, 1953. 9p. Contract AT(30-1)-1516. (NYO-6425)

A new type of goniometer has been designed for neutron diffraction analyses, and particularly for single crystal studies. The neutron detecting system employs a scintillation crystal and photomultiplier, and the detector and diffracting crystal are located within a cylindrical shielded region, in such a manner that the moving parts are entirely free of heavy shielding elements. Rotations are accomplished by selsyns geared down for power and accuracy, and controlling motors and indicators are outside the shielded region. The total external diameter of the system is two feet or slightly more. (auth)

4349

Oak Ridge National Lab.
LOW RESISTANCE RECORDER. George Ritscher. June 4, 1954. 7p. Contract W-7405-eng-26. (ORNL-1707)

An instrument for recording resistances of fractions of an ohm has been developed by the Industrial Instrument Engineering Section. The instrument has several advantages over the Kelvin bridge, which is commonly used in measurement of resistances less than one ohm; the more important are independence of resistance of leads and therefore lead length, simplicity of recorder circuit, and ease of providing multiple ranges. The recorder circuit compares the resistance of the specimen under test to that of a standard resistance by comparing the potential drop across the specimen to that across the standard resistance with the same current flowing through both. This is similar to a potentiometer measurement in which the unknown EMF is compared to the EMF of a standard cell (through a working battery). A modified recording potentiometer is the heart of the apparatus. (auth)

4350

Microwave Research Inst., Polytechnic Inst. of Brooklyn
DEVELOPMENT OF R.F. POWER METERS FOR THE FREQUENCY BAND 8,200–40,000 MC/SEC. QUARTERLY PROGRESS REPORT FOR THE PERIOD JULY 1, 1951 TO SEPTEMBER 30, 1951. Herbert J. Carlin and Allan V. James. Oct. 23, 1951. 25p. Contract W28-099-ac-503. (PIB-132.12; R-188.12-51; R-5750; ATI-133524)

4351

A LINEAR MOTION X-RAY SPECTROMETER. H. P. Hanson and H. W. Schrader (Univ. of Florida, Gainesville). Rev. Sci. Instr. 25, 422-3(1954) May.

A single-crystal x-ray spectrometer has been constructed in which the change in Bragg angle is effected through a linear rather than angular motion of the crystal. In certain measurement problems this design offers advantages over the conventional type from a standpoint of versatility and ease of alignment. (auth)

4352

EVACUATING PHOTOGRAPHIC MATERIALS FOR USE IN ELECTRON OPTICAL APPARATUS. John H. Reisner (Radio Corporation of America, Camden, N. J.). Rev. Sci. Instr. 25, 477-9(1954) May.

Vacuum systems containing photographic materials may be most rapidly pumped if the materials have been desiccated previously. The primary factors influencing pumping time are the degree of preliminary desiccation and the amount of resorption of water vapor during the transfer of the material from the desiccator to the vacuum apparatus. Desiccation may be achieved by the use of a drying agent, evacuation, or the elevation of temperature. Resorption of water vapor may be minimized by rapid transfer of materials in tight containers from the desiccation means to the vacuum apparatus. (auth)

4353

AN APPARATUS FOR THE ACCURATE MEASUREMENT OF INTERNAL FRICTION. John R. Pattison (Univ. of London, England). Rev. Sci. Instr. 25, 490-6(1954) May.

An electronic instrument which has been developed for the measurement of internal friction to a high level of accuracy is described. The device is actuated by an input signal consisting of a voltage-time decay wave form, with the necessary condition that the decay should follow an exponential law. The operation is both automatic and rapid so that the apparatus is suitable for investigating changes in damping when a given dependent parameter is varied. (auth)

4354

A LOW-TEMPERATURE LIQUID-IN-GLASS THERMOMETER. C. Hochanadel (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 25, 524(1954) May

A thermometer was constructed which extends the range of liquid-in-glass thermometers below the useful limit of the present pentane thermometers (~−185°C). The thermometers were constructed of pyrex glass and filled with a matrix of equal volume of propane and propylene. They performed satisfactorily from room temperature down to −215°C. (L.T.W.)

4355

A SIMPLE METHOD OF OBTAINING LOW-TEMPERATURE X-RAY DIFFRACTION PHOTOGRAPHS. S. C. Wallwork and T. T. Harding (Univ. of Nottingham, England). J. Sci. Instr. 31, 163-4(1954) May.

A simple method is described whereby a crystal mounted in the usual way on an oscillation goniometer may be maintained at a temperature of −30 to −60°C for at least an hour. Liquid air in a vacuum flask is boiled by electrical heating, and the cold gas is conveyed to the crystal through a well-lagged rubber tube ending in a glass tube supported about 3 mm above the crystal. The temperature may be varied by adjusting the rate of boiling of the liquid air. No precautions against ice formation are necessary. (auth)

4356

A LINDE HELIUM LIQUEFIER-CRYOSTAT COMBINATION SUITABLE FOR OPERATION DOWN TO 1.3°K. D. H. Parkinson (Radar Research Establishment, Malvern, Worcs, England). J. Sci. Instr. 31, 178-80(1954) May.

A simple Linde helium liquefier-cryostat combination is described which has a liquefaction rate of 800 cc/hr combined with reasonable economy in the use of liquid hydrogen. It is suitable for experiments down to 1·3°K, either by mounting the apparatus in an inner vacuum chamber and cooling it by condensation or by direct immersion down a 9·8-mm-bore tube to the main helium bath. (auth)

4357

CONTINUOUS-FLOW CELL FOR ABSORPTION MEASUREMENTS ON SOLUTIONS WHICH FADE. G. P. Cooke (Kodak Ltd., Middlesex, England). J. Sci. Instr. 31, 180-1(1954) May.

A description is given of a simple continuous-flow cell designed to reduce errors in absorption measurements caused when the solution is one which fades. An approximate calculation, based on the rate of fading of the solution, is also given which enables an estimate to be

made of the effectiveness of the device at different rates of flow. (auth)

4358

A NEW RADIOMETER. J. T. Houghton and A. W. Brewer (Clarendon Lab., Oxford, England). J. Sci. Instr. 31, 184-7 (1954) May.

A radiometer, which measures directly the flux of radiant energy integrated throughout a hemisphere, is described. It consists of a very light electrical resistance thermometer element which is suspended, thermally isolated in high vacuum, behind an infrared transmitting window. The front is blackened to receive the radiation, while the back is a bright mirror to prevent absorption or emission. The element comes into thermal equilibrium at a temperature T°K with an incoming radiation stream of energy F. Then $F = \sigma T^4$, with small corrections for heat leakage. The determination of these corrections is the only calibration which is necessary. The radiometer is robust, reasonably rapid in response, and is not affected by external airflow. For these reasons it is especially suitable for radiative flux measurements in the upper air from an aircraft. It may have other uses in heating and ventilating problems or wherever low-temperature radiation is important. (auth)

ISOTOPE SEPARATION

4359

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SEPARATION OF THE ISOTOPES OF BORON BY ISOTOPIC EXCHANGE EQUILIBRIUM. James F. Duncan. [1947?] 18p. (AERE-C/R-107)

The chemical exchange method of separating isotopes is discussed from a theoretical point of view to determine the kind of molecular species which are likely to take part in exchange reactions. The conditions most favorable to obtaining a high separation factor are indicated. The theoretical conclusions are applied to the separation of the boron isotopes, and several possible exchange reactions are suggested. (auth)

4360

Naval Research Lab., Univ. of Wis.

THE EFFECT OF ULTRASONIC RADIATION ON THE ELECTROLYTIC SEPARATION OF HYDROGEN AND DEUTERIUM. Donald Frank Mason. Nov. 15, 1952. 112p. Contract NOrd 9938. (NP-5196)

Results are reported from an experimental study of the effect of intense sound energy on the electrolytic separation coefficient of H_2 and D_2. Previous work on the electrolytic separation of H_2 and D_2, overvoltage measurements and theories, and the effects of ultrasonic radiation on overvoltage is reviewed. The experimental apparatus, techniques, and calculations are discussed. (C.H.)

4361

THE THEORY OF ISOTOPE SEPARATION THROUGH EXCHANGE REACTIONS. L. Waldmann. Translated by W. M. Jackson from Naturwissenschaften 31, 205-06(1943). 3p. (AEC-tr-1911)

The process of isotope separation through exchange reactions in gaseous and liquid phases is theoretically discussed. Equations are derived to describe the exchange, and two limiting cases are considered: (1) the gas molecules are dissolved unchanged into the liquid, and (2) the gas molecules are predominantly ionized in the solution. (J.S.R.)

4362

SEPARATION OF CHLORINE ISOTOPES BY ION-EXCHANGE CHROMATOGRAPHY. Tage Langvad (Univ. of Aarhus, Denmark). Acta Chem. Scand. 8, 526-7(1954) No. 3. (In English)

The separation of Cl isotopes chromatographically in a column of an ion exchange resin of the strong base type was investigated. The design of the column necessary for the separation is described. (J.E.D.)

MATHEMATICS

4363

ON THE THEORY OF FUNCTIONS THAT SATISFY A LINEAR PARTIAL DIFFERENTIAL EQUATION. 1. (Zur Theorie der Funktionen, Die Eine Lineare Partielle Differentialgleichung Befriedigen). Stefan Bergmann (Looz). Translated from Mat. Sbornik 2, 1169-98(1937). 48p. (AEC-tr-1913)

MEASURING INSTRUMENTS AND TECHNIQUES

4364

Servomechanisms Lab., Mass. Inst. of Tech.

ELECTRONIC NUCLEAR INSTRUMENTATION GROUP ANNUAL PROGRESS REPORT [FOR PERIOD ENDING] MARCH 1, 1954. T. S. Gray and A. B. Van Rennes. Mar. 1, 1954. 61p. Contract N5ori-07876. (NP-5186)

Research work is reported in development of components for use in high-level nuclear instrumentation systems. Progress is reported in the development of a rapid-response thermopile sensitive to neutrons; a low-impedance magnetic-modulator preamplifier suitable for use with the thermopile; a transistor carrier amplifier to follow the modulator; and an output amplifier suitable for driving a conversion transducer. Alternative detectors studied included a sonic neutron flux modulator and an a-c acoustic ionization chamber. An alternative modulator investigated consists of a rotating-converter type of modulator with brushes and slip rings. Progress is reported in the development of a frequency multiplier, a magnetically regulated d-c power supply, and a sinewave transistor oscillator for use with the magnetic modulator. Research was continued on a study of the statistical fluctuations in period-indicating meters, and on an improved system of pulse-height analysis for detector calibration for use in measurements and control at low neutron levels. (cf. NP-4646) (C.H.)

4365

Carnegie Inst. of Tech.

RESEARCH AND INVESTIGATION OF GAMMA RADIATION FROM RADIO-ACTIVE NUCLEI USING BETA RAY SPECTROGRAPH. TECHNICAL REPORT NO. 1 [FOR] MARCH 15, 1952 TO MARCH 14, 1953. INTERNAL CONVERSION IN Na^{22}. George W. Hinman and Richard D. Leamer. May 12, 1953. Contract DA-36-061-ORD-176. (NP-5194)

Design characteristics of a large double-focusing β-ray spectroscope are given. A study of the internal conversion effect for the 1.28 Mev level of Ne^{22} is reported; the value of the conversion coefficient found is $\alpha_R = (0.75 \pm 0.12) \times 10^{-5}$. Based on the experimental evidence available on the Na^{22} decay, the spins and parities of the 1.28 Mev level in Ne^{22} and the ground level in Na^{22} are concluded to be 2^+ and 3^+, respectively. (auth)

4366

Johns Hopkins Univ.

STUDIES OF FAST NEUTRONS AND FAST NEUTRON REACTIONS. Oct. 1952. 71p. Contract AT(30-1)-1251. (NYO-3861)

A program to improve the techniques of fast neutron energy and intensity measurement is described. The application of scintillation counters and neutron spectrometers is emphasized. (K.S.)

4367

A SLOTTED IONIZATION CHAMBER FOR THE MEASUREMENT OF γ-RAYS. I. V. Estulin. Translated from Zhur.

Eksptl'. i Teoret. Fiz. 21, 1412-15(1951). 6p. (AERE-Trans-11/3/5/234; AEC-tr-1393)

Measurements of ionization from γ rays were made in a slotted air ionization chamber of 400 cm^3 volume, with walls of C, Al, Fe, Cu, Sn, and Pb. The ratios were obtained of the equilibrium intensity of electrons originating under the action of γ rays in the various materials. (auth)

4368

ON THE TEMPERATURE DEPENDENCE OF BF_3 PROPORTIONAL NEUTRON COUNTERS. J. A. Lockwood, F. R. Woods, and E. F. Bennett (Univ. of New Hampshire, Durham). Rev. Sci. Instr. 25, 446-9 (1954) May.

The results of an experimental study of the temperature dependence of commercial BF_3 neutron counters are reported. The arrangement used for this investigation is described, and the results analyzed. The conclusion is reached that during a given pulse there is an increase in the number of negative ions formed by electron attachment with an increase in temperature of the tube. This effect is an equilibrium process. Upon reduction of the tube temperature the tube characteristics return to their original values. The consequence of this temperature dependence on the resultant counting rate is discussed. (auth)

4369

USE OF PROPORTIONAL COUNTERS IN THE MEASUREMENT OF THE SPECIFIC IONIZATION OF CHARGED PARTICLES. G. Igo and R. M. Eisberg (Univ. of California, Berkeley). Rev. Sci. Instr. 25, 450-3(1954) May.

A method has been developed to obtain an accurate estimate of the mean ionization of energetic, heavy charged particles using a device which has small stopping power. A sample of the frequency distribution of energy losses in each of n identical proportional counters is obtained. This information is treated by selecting the smallest of the n pulses and using this smallest pulse to represent the mean ionization of the particle. The experimental results are compared with Landau's theory of the statistical fluctuations in the specific ionization of charged particles. (auth)

4370

TECHNIQUES USEFUL IN EVACUATING AND PRESSURIZING METAL CHAMBERS. H. V. Neher and Alan R. Johnston (California Inst. of Tech., Pasadena). Rev. Sci. Instr. 25, 517-18(1954) May.

Problems encountered in evacuating and baking out metal chambers and then either leaving them evacuated or filled with a gas are discussed. Methods of securing leakproof seals are described. (L.T.W.)

4371

IMPROVED METHOD OF CONTROLLING THE EXPANSION RATIO OF CLOUD CHAMBERS. G. Pfotzer (Max-Planck Institut für Physik der Stratosphäre, Weissenau bei Ravensburg, Germany). Rev. Sci. Instr. 25, 521-2(1954) May.

An improved method for controlling the expansion of cloud chambers is described, in which the piston itself controls a valve for the supply of the compression air. (L.T.W.)

4372

AN INSTRUMENT FOR MEASURING THE DECAY OF Mu-MESONS. H. S. Hans (Muslim Univ., Aligarh, India). Indian J. Phys. 28, 93-102(1954) Feb. (In English).

An electronic instrument designed to study many problems connected with the decay of μ mesons is discussed in detail. Special coincidence circuits, which differ from ordinary coincidence circuits in the fact that the output pulse from the special coincidence corresponds to the first input pulse, rather than to the last one, are used for recording the incoming mesons and the decay electrons. Many channels of delayed coincidences are used so that several points on the decay curve can be obtained simultaneously. (auth)

4373

BORON-LOADED PHOTOGRAPHIC PLATES AS DETECTORS OF SLOW NEUTRONS. A. R. Bake. (Univ. of Cambridge, England). J. Sci. Instr. 31, 187-9(1954) May.

The variations with position in the plate of the emulsion thickness and of the number of slow neutrons recorded per unit area have been determined for a 10-in. × 8 in. × 100 μ boron-loaded plate that had been irradiated uniformly with slow neutrons. The measurements were consistent with a constant concentration of boron throughout the plate, and upper limits were placed on possible variations. Comparative slow neutron flux measurements with disks of stripped emulsion from the same sheet should have a standard error of 3% at most. (auth)

4374

INEXPENSIVE X-RAY DETECTORS. U. W. Arndt (The Royal Institution, London, England). J. Sci. Instr. 31, 192-3 (1954) May.

A reasonably accurate x-ray detection system employing a Geiger counter without using any additional apparatus other than a number of high-tension dry batteries and a galvanometer is described. (L.T.W.)

4375

CONDENSER DOSIMETER FOR ROENTGEN AND GAMMA RADIATION. A. N. Krongaus, D. A. Shtov, and I. M. Parshin. Vestnik Rentgenol. i Radiol., No. 6, 82-7(1953) Nov.-Dec. (In Russian)

A portable condenser-type dosimeter for measurement of doses of gamma radiation was developed at the experimental workshops of the State Inst. of Roentgenology and Radiology im. V. M. Molotov. This dosimeter works on the same principle as the "Viktorin" dosimeter. Because of its lightness and compactness it can be conveniently carried or transported from one place to another. Construction of the portable condenser dosimeter is described in some detail and illustrated by photographs, charts, and formulas. The dosimeter has interchangeable ionization chambers for the following types of radiation: normal, weak, soft, and gamma. Control with radioactive substances is carried on in the same manner as with the "GRI" dosimeter. (J.S.R.)

4376

δ-RAY COUNTING AS AN AID TO DISTINGUISHING BETWEEN SINGLY CHARGED PARTICLES OF DIFFERENT MASS. A. D. Dainton and P. H. Fowler (Univ. of Bristol, England). Proc. Roy. Soc. (London) A221, 414-19(1954) Jan. 27

Observations on the δ rays with the tracks of singly-charged particles can contribute to the problem of distinguishing particles of different mass. Therefore the distribution of δ rays along tracks of protons brought to rest in photographic emulsions was determined. With this information, determination was made of the relative numbers of protons, deuterons and tritons among the singly-charged particles brought to rest in emulsions exposed to cosmic radiation at high altitudes. Knowledge of the distribution of δ rays on tracks of low-energy protons has two applications to current investigations employing 'nuclear' plates: (a) in the selection, for calibration purposes, of protons without an admixture of deuterons; and (b) in the analysis of real or suspected heavy-meson events. (auth)

MESONS

4377

Palmer Physical Lab., Princeton Univ.

ABSORPTION OF NEGATIVE μ MESONS IN CARBON (thesis). Thomas N. K. Goofrey. May 20, 1954. 99p. Contract N6onr-270-11, Technical Report No. 13. (NP-5178)

A measurement was made of the rate, P_B, of the absorption reaction that results in a bound state of B^{12}, for the purpose of making a comparison between the coupling constants of β decay and μ-meson absorption. It is shown that there is a simple relationship between the rate of the β decay of B^{12}, the rate of the meson absorption reaction in which the ground state of B^{12} is formed, P_μ, and the ratios of the coupling constants for the two processes. Since the two processes involve the same pair of nuclear states, the details of the nuclear wave functions do not enter the above-mentioned relationship. An argument is made to support the assertion that in most cases, if the product of the absorption of a meson by carbon is a bound state of B^{12}, that state is the ground state, and therefore that $P_B = P_\mu$. From the measured value of P_B and the known rate of the β decay of B^{12}, it was concluded that the ratio of the square of the coupling constant of β decay to that of μ-meson absorption is 0.94 ± 0.26 where the indicated uncertainty is an estimated standard deviation, arising primarily from the statistical uncertainty in counting the number of events. P_B was measured by observing the fates of several thousand cosmic-ray μ mesons that stopped in an organic liquid scintillation counter. Those mesons that decayed gave two pulses with a mean separation of about 2 μsec, the first pulse being due to the stopping meson and the second to its decay electron. The mesons that were absorbed by carbon, the product nucleus being a bound state of B^{12}, gave two pulses with a mean separation of 32 millisec. In this case the second pulse was caused by the β decay of the B^{12} nucleus. P_B was calculated from the counted numbers of meson-decay events and B^{12} decay events and the known rate of decay of the μ meson. One other conclusion was obtained by comparing the measured value of P_B with the total absorption rate of μ mesons in carbon, which has been measured by others. The ratio of P_B to the total absorption rate, 0.13 ± 0.05, shows that in most events in which a μ meson is captured by carbon, an unbound state of B^{12} is formed. It is shown that the result sets a lower limit of 0.83 ± 0.06 to the average number of neutrons emitted by B^{12} after the absorption of a μ meson. (auth)

4378

REACTIONS PRODUCED BY μ MESONS IN HYDROGEN. Ya. B. Zel'dovich. Doklady Akad. Nauk S.S.S.R. 95, 493-6(1954) Mar. 21. (In Russian)

4379

MEASURE OF THE MASS OF CHARGED PARTICLES BY GRAIN COUNTING IN EMULSIONS WITHOUT SUPPORT. Tchang-Fong Hoang. Compt. Rend. 238, 1790-2(1954) May 3. (In French)

The average mass of 20 π mesons, each having a track longer than 2 cm and an inclination less than 20°, was determined from counting the grains of the nuclear emulsion. The average mass ($M = 276.5 \pm 16.5\ m_e$) was calculated from the two formulas $g = \lambda\ dE/dR + \mu$ and $E/M = E/M = a\ (R/M)^b$ where g is the grain density, E, the energy, R, the path length, and a, b, λ, and μ are constants. (J.S.R.)

4380

μ-MESON DECAY SPECTRUM. J. H. Vilain and Robert W. Williams (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 94, 1011-17(1954) May 15.

The energy spectrum of positrons from the decay of muons at rest has been measured, using a synchrotron as the meson source and a magnetic-field cloud chamber as the spectrometer. A total of 830 tracks was obtained, and the relation between this sample and the true decay spectrum is discussed in some detail; difficulties which may have led to the discrepancies among previously measured spectra are pointed out. A strict set of selection criteria reduced the sample to 280 tracks; from this it is found that the spectral intensity does not go to zero at the upper energy limit, but retains a large value. In terms of Michel's parameter, $\rho = 0.50 \pm 0.13$. (auth)

4381

CLASSICAL SCATTERING OF MESONS. S. P. Pandya (Delhi Univ., India). Phys. Rev. 94, 1037-8(1954) May 15.

The theory of "action at a distance" proposed by Wheeler and Feynman for electrodynamics has been extended by various authors to meson fields. It is shown here that the cross sections for the scattering of mesons by nucleons in various cases (charge, dipole, or isotopic spin scattering for scalar or vector mesons) obtained in this theory differ from those obtained in the classical field theory by the absence of those terms which have been interpreted as modification of the nucleon parameter involved in the scattering, due to the reaction of the meson field on the nucleon. (auth)

4382

NUCLEAR INTERACTION OF FAST μ MESONS. Martin Annis, Homer C. Wilkins, and John D. Miller (Washington Univ., St. Louis, Missouri). Phys. Rev. 94, 1038-45(1954) May 15.

An experimental study has been made of events in which a fast μ meson interacts with a nucleus to produce at least one evaporation neutron. The experimental results of major importance are $\sigma\overline{m} = (9.1 \pm 1.2) \times 10^{-27}$ cm^2/Fe-nucleus; $1.03 < \overline{m} < 7.7 \pm 2.2$; and $(1.2 \pm 0.4) \times 10^{-27}$ cm^2/Fe-nucleus $< \sigma < (8.8 \pm 1.1) \times 10^{-27}$ cm^2/Fe-nucleus, where σ is the cross section for such events and $\overline{m}$ is the mean multiplicity of evaporation neutrons emitted. These results are in good agreement with the results of calculations based on present information on the nuclear interaction of γ rays, which lead to the prediction of a σ of about 2.4×10^{-27} cm^2/Fe-nucleus and an $\overline{m}$ of about 3.3. The surprisingly large cross section and small mean multiplicity of neutrons are shown to be reasonable by calculating that about 90 percent of all μ-meson nuclear interactions result in the transfer to the nucleus of less than 300 Mev. (auth)

4383

DECAY OF τ MESONS OF KNOWN CHARGE. R. H. Dalitz (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 94, 1046-51 (1954) May 15.

The experimental data on the 3π decay of τ mesons is summarized on a convenient two-dimensional plot, both (a) when the π-meson charges are known and (b) when they are not. Some events may be included in plot (a) only if the parent τ meson is assumed positive and arguments supporting this identification for τ mesons decaying in an emulsion are discussed. The dependence of this plot on the τ-meson spin (j) and parity (w) is discussed in general terms and those features depending particularly on w and its relation with j are emphasized—for example, if the density of events does not vanish at the bottom of the plot, the τ meson must have odd parity and even spin. Simple estimates of the distribution, using only the lowest allowable angular momenta and a "short range" approximation, may be modified by final-state meson-meson attractions, whose effects are discussed qualitatively. The available data are insufficient for any strong conclusion to be drawn but rather suggest even spin and odd parity for the τ meson; the need for careful assessment of geometrical bias in the selection of experimental material is stressed. (auth)

4384

V-PARTICLES AND HEAVY MESONS. C. F. Powell.

Proc. Roy. Soc. (London) A221, 278-92(1954) Jan. 27.

A brief review of V particles and heavy mesons is given. The subject is treated in such a way that the main problems and methods might be understood by scientists not specialists in the field. It seemed profitable to include a brief outline of the history of the discovery of the μ and π mesons, both for completeness and because the methods employed are closely similar to those being used in the study of heavier mesons. A glossary of the principal terms employed is given as an appendix. (auth)

4385

OBSERVATIONS ON THE DECAY OF HEAVY MESONS IN PHOTOGRAPHIC EMULSIONS. M. G. K. Menon (Univ. of Bristol, England) and C. O'Ceallaigh (Univ. Coll., Cork, Eire). Proc. Roy. Soc. (London) A221, 292-318(1954) Jan. 27.

Eighteen examples of κ decay have been found in this laboratory. They are referred to as K3, K4 . . . , K20. The conditions of exposure of the plates in which they were recorded are given. Preliminary measurements, and conclusions following from them, are reported together with a detailed account of the measurements and their interpretation. (auth)

4386

SOME SLOW K-PARTICLES, THEIR DECAY AT REST AND PRODUCTION IN COSMIC-RAY STARS. A. Bonetti, R. Levi Setti, M. Panetti (Univ. of Milan, Italy) and G. Tomashini (Univ. of Genoa, Italy). Proc. Roy. Soc. (London) A221, 318-27(1954) Jan. 27

Four unstable particles which enter into the class of K particles are described. Two of the four K particles, K_1 and K_4, came from outside the emulsion, and were found during the measurements on the μ decay spectrum. The other two, K_2^+ and K_3^+, were produced in stars in the emulsion. (auth)

4387

THE DECAY PROCESSES OF NEUTRAL V-MESONS. K. H. Barker (Univ. of Manchester, England). Proc. Roy. Soc. (London) A221, 328-38(1954) Jan. 27.

The evidence for the existence of neutral V mesons, and the probable nature of their decay products, are discussed. An explanation of all the available experimental data is given in terms of two two-body decay processes. There is strong support for a V_1^0 meson decaying into two light charged mesons; if they are π mesons the mass of the V_1^0 meson is $(964 \pm 40)m_e$. Several particles which cannot be explained in this way may be examples of the decay of a V_2^0 meson, involving the production of a light and a heavy charged meson, with a Q value between 50 and 70 Mev. Some possible relationships between the V^0 mesons and the heavy charged mesons are discussed, and, in particular, it is suggested that the V_2^0 meson might be a neutral τ meson. (auth)

4388

S-PARTICLE AND CHARGED V-PARTICLES. C. C. Butler (Univ. of Manchester, England). Proc. Roy. Soc. (London) A221, 339-50(1954) Jan. 27.

A detailed discussion is given of the known properties of the unstable S particles and charged V particles, other than their lifetimes. S particles are singly charged and decay at rest in thin lead plates inside a cloud chamber into one charged secondary particle and one or more neutral particles. Charged V particles are also singly charged and decay in flight in the cloud-chamber gas into a charged secondary particle and one or more neutral particles. Some of the S particles are probably identical with the χ particle, and the charged V particles probably consist of a mixture of κ and χ particles. (auth)

4389

PRODUCTION OF HEAVY MESONS BY PROTONS OF ENERGY BETWEEN 2 AND 3000 GEV. R. R. Daniel and D. H. Perkins (Univ. of Bristol, England). Proc. Roy. Soc. (London) A221, 351-66(1954) Jan. 27.

The masses of the secondary particles emitted from disintegrations produced by cosmic-ray protons of energy greater than 2 bev have been determined by observations on the grain density and scattering of their tracks in photographic emulsions. It has thus been possible to determine the yield of the heavy charged mesons with mass between 900 and $1400m_e$, as a function of the energy of the primary particles. Among 325 secondary particles which produce tracks with grain density between 1.07 and 2.0 times the minimum value, twenty heavy mesons have been identified. The statistical distribution in the measured values of their mass is consistent with a unique value of $1210 \pm 40m_e$. The total observed proper time of flight of these particles is 2.9×10^{-10} s; no example of decay 'in flight' has yet been observed. The rate of production of these heavy mesons, referred to as K particles, has been compared with the frequency with which heavy mesons are observed to decay at rest; the ratio is consistent with the estimated lifetime of the K particles. In the disintegrations produced by primary particles of energy greater than ~20 bev, approximately equal energy goes into production of π and K particles. The yield of K particles at a primary energy of 2 to 3 bev is estimated to be a few per cent per primary interaction. The results suggest that not only π mesons but also κ mesons are 'heavy quanta' associated with the nuclear field. If charged mesons of mass between 276 and $900m_e$ are created directly in showers, they occur with a frequency <1% of the π particles. (auth)

4390

A STUDY OF A DISINTEGRATION PRODUCED BY A PARTICLE OF ENERGY ~20000 GEV. J. H. Mulvey (Univ. of Bristol, England). Proc. Roy. Soc. (London) A221, 367-83 (1954) Jan. 27.

A detailed investigation has been made of a nuclear disintegration produced by a charged particle, almost certainly a proton, of energy ~20,000 bev. The disintegration, of type 22 + 76p, was recorded in a stack of plates exposed at ~90,000 ft. The jet of secondary charged particles, and the associated cascade of electrons and photons, can be followed through the emulsion of twenty-two plates. The observations lead to a value 0.25 for the ratio of neutral π particles to charged shower particles produced in the disintegration. If π^0 mesons are produced in high-energy nuclear interactions with a frequency half that of the charged π mesons, and if 10% of the shower particles are assumed to be protons, the present results indicate that 40% of the charged shower particles are other than π mesons. As there is no evidence for the existence of nucleon pairs, it is reasonable to identify these other particles with the heavy κ particles. The corresponding ratio of the numbers of charged κ to π mesons, $N_{\kappa\pm}/N_{\pi\pm}$, is equal to 0.80 ± 0.4. The interaction length of the shower particles from the event, without distinction between the different types of mesons which may be among them, is shown to be very nearly equal to the value for nucleons. It follows that the κ mesons, which constitute a large fraction of the shower particles, interact strongly with nuclei. (auth)

4391

ANALYSIS OF A τ-MESON OBSERVED IN A PHOTOGRAPHIC EMULSION EXPOSED AT 26,000 m. G. Baroni, C. Castagnoli, G. Cortini, C. Franzinetti, and A. Manfredini (Istituto di Fisica dell'Universita, di Roma, and Istituto Nazionale di Fisica Nucleare, Sezione di Roma). Proc. Roy. Soc. (London) A 221, 384-6(1954) Jan. 27.

A nuclear event was observed which is interpreted as a decay at rest of a τ meson. Particle 1 enters the surface of the emulsion and stops in P. The increase of ionization and

scattering establishes the direction of motion of the particle which produced the track. Three other particles leave P at different angles (particles 2, 4, and 5). The tangents at P of the trajectories of these particles are coplanar within 1 degree. Particle 2 has a residual range of ~690μ, and at its end disintegrates into an ionizing particle, track 3, (which leaves the emulsion after a path of 510μ) and an unknown number of neutral particles. By scattering and ionization measurements it was shown that the mass of particle 2 was less than 700 m_e; it cannot therefore have been a proton. The most probable interpretation, as discussed later in detail, is that particle 3 is a μ meson, and particle 2 a π^+ meson. As far as we know this is the first observation of a τ disintegration with an associated π-μ decay. (auth)

4392

AN EXAMPLE OF A τ-MESON GENERATED IN A NUCLEAR ENCOUNTER AT HIGH ENERGY. M. Ceccarelli, N. Dallaporta, M. Merlin, G. Quareni, and G. T. Zorn (Istituto di Fisica dell'Universita, di Padova and Istituto Nazionale di Fisica Nucleare, Sezione di Padova). Proc. Roy. Soc. (London) A221, 386-9(1954) Jan. 27.

In one of a sandwich of two Ilford G5 plates 1200 μ thick, exposed emulsion to emulsion at an altitude of 90,000 ft for 5½ h, and at a geomagnetic latitude of 40° N in one of the Sardinian flights of 1952, a τ meson was observed to have been emitted from a nuclear disintegration. In the adjacent plate the τ meson was brought to rest and subsequently decayed. The star is comprised of ten minimum tracks, one of which may be attributed to the primary, three black tracks, and one grey track (that due to the τ-meson). The 'primary' and axis of the shower are inclined at 60° with respect to the plane of the emulsion, thus permitting no direct energy measurements; however, considering the median angle of the shower and its multiplicity, the primary energy has been estimated to be at least 30 bev. (auth)

4393

THE PRODUCTION OF τ-MESONS. P. E. Hodgson (Imperial Coll. of Science and Tech., London). Proc. Roy. Soc. (London) A221, 389-90(1954) Jan. 27.

The production of τ mesons from hydrogenous and heavier materials when bombarded by high-energy particles is discussed on the basis of recent experiments. (L.M.T.)

4394

DECAY OF A τ-MESON. W. O. Lock and J. V. Major (Univ. of Manchester, England). Proc. Roy. Soc. (London) A221, 391-4(1954) Jan. 27.

A τ-meson decay has been observed in an Ilford G5 emulsion exposed under 14.5 cm of iron at an average height of 35,000 ft. Measurements made on the secondary particles suggest that they are all π mesons. The Q value of the decay is (79 ± 3.5) Mev, corresponding to a mass for the τ meson of (983 ± 10)m_e. The data now available on τ mesons are briefly discussed. (auth)

4395

A SEARCH FOR NUCLEAR DISINTEGRATIONS PRODUCED BY SLOW NEGATIVE HEAVY MESONS. M. W. Friedlander, G. G. Harris, and M. G. K. Menon (Univ. of Bristol, England). Proc. Roy. Soc. (London) A221, 394-405(1954) Jan. 27.

Preliminary results of a search for evidence of the nuclear interactions of negative heavy mesons are described. A qualitative analysis is given of the possible characteristics of their interactions and the appearance these might be expected to have in photographic emulsions. 37 ml of emulsion, in which are recorded 10,000 stars and 1200 slow π mesons, have been completely examined. In the conditions of exposure, such a volume should contain six examples, with good geometry, of the decay of heavy mesons. Mass measurements have been carried out, by the range/scattering method, on 417 tracks of σ mesons. In addition, 1800 σ mesons, observed in 42 ml of emulsion, have been examined. No disintegrations which can be attributed to heavy mesons, on being brought to rest in photographic emulsions, behave in a manner qualitatively different from that of negative π particles. Possible explanations for this result are suggested. (auth)

4396

THE MEAN LIFETIME AND FREQUENCY OF PRODUCTION OF CHARGED V-PARTICLES. J. A. Newth (Univ. of Manchester, England). Proc. Roy. Soc. (London) A221, 406-11(1954) Jan. 27.

The evidence from four cloud-chamber experiments is consistent with a single value of the mean lifetime of all charged V and S particles. This value is between 4×10^{-9} and 10^{-8} s. If the V particles are a mixture of different types of particles, it is unlikely that more than 20% of them have a lifetime outside these limits. (auth)

4397

S-PARTICLES AND χ-MESONS. J. P. Astbury (Univ. of Manchester, England). Proc. Roy. Soc. (London) A221, 412(1954) Jan. 27.

Bridge et al. (Phys. Rev. 90, 921(1953)) suggested that all S particles are χ mesons. A discussion of a recent experiment is presented in which the lifetime of a V_2^0 particle was determined, and results indicate that the V_2^0 lifetime cannot be as long as that postulated for the χ meson. (L.M.T.)

4398

THE PRODUCTION OF V-PARTICLES IN LOW-ENERGY INTERACTIONS. D. D. Millar. Proc. Roy. Soc. (London) A221, 412-13(1954) Jan. 27.

A discussion is presented from a recent experiment conducted at the Jungfraujoch, in which cloud-chamber photographs show the production of V particles in interactions of very low multiplicity. (L.M.T.)

4399

AN ATTEMPT TO DETECT THE ARTIFICIAL PRODUCTION OF V^0-PARTICLES BY HIGH-ENERGY PHOTONS. G. Bernardini and E. Segré (Univ. of Illinois, Urbana). Proc. Roy. Soc. (London) A221, 413-14(1954) Jan. 27.

A beam of γ rays from a betatron were allowed to strike an Al cylinder and nuclear emulsions were placed so as to intercept mesons produced in the cylinder at a convenient angle; no direct production by γ rays in the emulsion could take place. No V^0 particles were identified and an upper limit for V-particle production by γ rays in Al is $\sigma_\mu = 2 \times 10^{-4}\, \sigma_\pi$. (L.M.T.)

4400

DISCUSSION ON κ-MESONS EMERGING FROM STARS. N. Dallaporta (Istituto di Fisica dell'Universita, di Padova). Proc. Roy. Soc. (London) A221, 420(1954) Jan. 27

A κ meson emerging from a 'star' has been observed and studied. The star has 33 ionizing tracks, 16 of which are black, 13 grey and 4 at minimum. It seems to represent the complete, or nearly complete, disintegration of a heavy nucleus of the emulsion. None of the ionizing particles appears to be sufficiently energetic to be the primary of the event, and it is therefore assumed that the primary was a neutron. The total amount of energy represented by the tracks from the 'star' is about 6 bev. The κ meson is very short and decays at rest after 297 μ of path in the emulsion. The secondary is also short and comes out from the emulsion after 600 μ of path; its ionization is 1.05 ± 0.5 times minimum; the pβ value is about 158 ± 33.3 Mev/c. Gap-range measurements on the primary indicate that its mass is nearer to the value of the proton than that of the π meson. (auth)

NEUTRONS

4401

ABSOLUTE MEASUREMENT OF THE UNION MINIERE NEUTRON STANDARD. A. De Troyer and G. C. Tavernier (Union Minière du Haut-Katanga, Brussels, Belgium). Bull. Classe Sci. Acad. 40, 150-66(1954) Feb. (In French)

Neutron emission from the Union Minière standard (502.4 mc) was measured by integration of the spatial distribution of neutrons slowed in water. The spatial distribution, the same as the absolute flux measurement at 10 cm from the source, was determined with Au foil. Different connections were studied and applied. The total emission, reduced to its value on the fabrication date (April 1951), is 7.802×10^6 n/sec (± 2%) or 15.53×10^6 n/sec/gm of Ra. Several comparisons with other absolute measurements are presented (tr-auth)

4402

ON THE THEORY OF PROBE PERTURBATION IN A NEUTRON FIELD. M. A. Vigon and K. Wirtz (Max-Planck Institut für Physik, Göttingen, Germany). Z. Naturforsch. 9a, 286-91(1954) Apr. (In German)

A probe decreases the density of the surrounding neutron field. The probe indicates too little and disturbs neighboring probes. One must therefore introduce corrections in the probe data. These corrections were calculated by means of the elementary diffusion theory for the spherical probe as well as for the infinitely expanded and finite circular disk probe. (tr-auth)

4403

ON THE DIFFUSE REFLEXION OF NEUTRONS BY A SINGLE CRYSTAL. R. D. Lowde (Atomic Energy Research Establishment, Harwell Berks, England). Proc. Roy. Soc. (London) A221, 206-23(1954) Jan. 21.

The thermal diffuse reflections from a single crystal result from an exchange of energy, as well as momentum, between the beam and the crystal. The theory is outlined for the case of neutron radiation, and some properties of the diffuse reflections are derived. Diffuse streaks have been found in the Laue diffraction pattern of an iron single crystal placed in an unmonochromatized beam of neutrons from the Harwell pile. The 110 streak has been studied in detail, and its behavior is compared with calculations from the Weinstock-Waller-Froman theory of inelastic neutron scattering. The theory is verified to within about 15%. Inelastic scattering cross-sections are given for neutrons incident at 20° on the (110) plane; they are in the region of 10 millibarns. (auth)

NUCLEAR PHYSICS

4404

ON THE DEVELOPMENT OF A MONTE CARLO METHOD FOR STUDYING THE PASSAGE OF HIGH-ENERGY NUCLEONS THROUGH NUCLEI. Pierre Cüer and Jean Combe. Compt. rend. 238, 1799-1801(1954) May 3. (In French)

A Monte Carlo machine supplemented with a spatial mechanical representation of a nucleus was used to study separately and vigorously the passage of 340-Mev protons in light and heavy nuclei of a sensitive emulsion. Some parameters such as the mean free path in the nuclear material and the moment distribution of nuclei are still badly defined experimentally. (tr-auth)

4405

MANGANESE-57. B. L. Cohen, R. A. Charpie, T. H. Handley, and E. L. Olson (Oak Ridge National Lab., Tenn.). Phys. Rev. 94, 953-4(1954) May 15.

A previously unknown isotope, 1.7-minute Mn^{57}, was produced by an (n,p) reaction on isotopically enriched Fe^{57}. It was identified by chemical separations, by measurement of its formation cross section, by investigation of possible impurity effects, and by comparison of its gamma spectrum with that of Co^{57}. It decays principally by 2.6-Mev negatron emission to the 131-kev excited state of Fe^{57}, which in turn decays to either the ground or the 14-kev state of Fe^{57} with approximately equal probability. The gamma-ray spectrum also indicates the presence of a weak 690-kev gamma ray, and possible weak gamma rays of 350 kev and 220 kev. It is shown that a previous assignment of a 7.2-day activity to Mn^{57} is very probably in error. (auth)

4406

EXPERIMENTS ON NUCLEAR ORIENTATION AT VERY LOW TEMPERATURES. I. ESTABLISHMENT OF A METHOD OF NUCLEAR ALINEMENT AND ITS APPLICATION TO COBALT-60. B. Bleaney, J. M. Daniels, M. A. Grace, H. Halban, N. Kurti, F. N. H. Robinson, and F. E. Simon (Univ. of Oxford, England). Proc. Roy. Soc. (London) A 221, 170-88(1954) Jan. 21.

Experiments have been carried out which demonstrate the possibilities of the method of 'magnetic hyperfine-structure alignment' for the orientation of nuclei. Single crystals of composition (1% Co, 12% Cu, 87% Zn) $Rb_2(SO_4)_2 \cdot 6H_2O$ were cooled by adiabatic demagnetization to 0.01°K. The crystals contained a small quantity of radioactive Co^{60}, which decays by β emission followed by two γ rays in cascade. The anisotropic distribution of the γ rays from the oriented Co^{60} nuclei was measured by an array of Geiger counters around the cryostat. The largest anisotropy observed was 33%, and the change in this anisotropy as the crystals warmed up to 1°K was fitted to theoretical curves where the only unknown parameter was the magnetic moment of Co^{60}, for which a value of 3.5 ± 0.5 nuclear magnetons was deduced. (auth)

NUCLEAR PROPERTIES

4407

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

FAST NEUTRON INELASTIC SCATTERING. Robert Mitchell Kiehn. Dec. 15, 1953. 117p. Contract N5ori-07806, Technical Report No. 64. (NP-5180)

The neutron inelastic scattering cross sections of Fe, Al, Cr, Ni, Pb, and Bi were measured with ~20-kev resolution for neutron energies between 0 and 2.7 Mev. The inelastic event was detected with a single-crystal NaI(Tl) γ spectrometer by measuring the yield of the monoenergetic γ rays emitted by the excited nucleus. The magnitudes of the cross sections are in good agreement with the predicted values as calculated from the Hauser-Feshbach theory. The experimental resolution was good enough to pick out resonant structure in the inelastic cross sections. The experimental method also allowed the determination of the first few excited states of the stable nuclei observed. The energies of these excited states were found to be in good agreement with values obtained by other means. New levels were found in Bi and I. The total neutron cross sections of C, Cl, and P were also measured in good geometry and with 2-kev resolution for 100 kev $< E_n <$ 1.2 Mev. Many resonances were observed in the latter two nuclei in agreement with the expected high-level densities of their respective compound nuclei. (auth)

4408

Vanderbilt Univ.

A THEORETICAL INVESTIGATION OF SEVERAL POSSIBLE APPROACHES TO THE PROBLEM OF NUCLEAR SHELL STRUCTURE. TECHNICAL REPORT NO. 1. SOME PROPERTIES OF NUCLEAR NORMAL MODES. Ingram Bloch

and Yü-Chang Hsieh. May 17, 1954. 16p. Contract DA-33-008-ORD-408. (NP-5182)

Energy levels and antisymmetric eigenfunctions are calculated, with the aid of normal coordinates, for a nuclear Hamiltonian containing internucleon potentials of the Hooke's law type. Such a nuclear model exhibits the same shell structure as do the same nucleons moving without interaction in a common harmonic-oscillator central field. Modifications in the Hamiltonian—use of force parameters which depend on A, cutting off of forces at finite range, and inclusion of spin-orbit forces—are discussed in connection with shell structure and the nuclear photoeffect. (auth)

4409

ENERGY LEVELS OF LIGHT NUCLEI (Z = 11 TO Z = 20). P. M. Endt (Rijksuniversiteit, Utrecht, Netherlands) and J. C. Kluyver (Stichting Fundamenteel Onderzoek der Materie, Utrecht, Netherlands). Revs. Mod. Phys. 26, 95-166(1954) Jan.

4410

THE HYPERFINE STRUCTURE OF THE $3P_{3/2}$ STATE OF Na^{23}. Paul L. Sagalyn (Mass. Inst. of Tech., Cambridge). Phys. Rev. 94, 885-92(1954) May 15.

Two of the separations in the hyperfine structure of the $3P_{3/2}$ state of Na^{23} were measured. The results are 61 ± 2 Mc/sec and 36.6 ± 2 Mc/sec. These results were assigned to the (F = 3 ↔ F = 2) and (F = 2 ↔ F = 1) separations. A value of Q = + 0.1 ± 0.06 × 10^{-24} cm^2 was calculated for the nuclear electric quadrupole moment. (auth)

4411

POLARIZATION FROM ISOLATED RESONANCES. A. Simon and T. A. Welton (Oak Ridge National Lab., Tenn.). Phys. Rev. 94, 943-4(1954) May 15.

Polarization from nuclear reactions may be obtained even from a single isolated level of the compound nucleus. Some aspects of this type of polarization are discussed and the implications of the one-level Wigner-Eisenbud formula are considered in this connection. A conjecture of Coester is discussed and compared with the Wigner-Eisenbud result. (auth)

4412

CURIUM ISOTOPES 246 AND 247 FROM PILE-IRRADIATED PLUTONIUM. C. M. Stevens, M. H. Studier, P. R. Fields, J. F. Mech, P. A. Sellers, A. M. Friedman, H. Diamond, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 94, 974(1954) May 15.

Mass spectrometric analyses show the presence of Cm^{246} and Cm^{247} in curium samples produced from neutron-irradiated plutonium. The pile-neutron capture cross sections of Am^{243}, Cm^{244}, Cm^{246}, Cm^{248} are 115 ± 20, 25 ± 10, 200 ± 100, and 15 ± 10 barns, respectively. The alpha-disintegration half life of Cm^{244} is calculated to be 19.2 ± 0.6 years. (auth)

4413

ANALYSIS OF 405-MEV PROTON AND 222-MEV NEGATIVE PION STARS. A. D. Sprague (DePauw Univ., Greencastle, Ind.), D. M. Haskin, R. G. Glasser, and Marcel Schein (Univ. of Chicago, Ill.). Phys. Rev. 94, 994-7(1954) May 15.

An analysis is carried out of star formation in emulsion by 405-Mev protons and 222-Mev negative pions produced in the University of Chicago 450-Mev synchrocyclotron. A comparison of the proton stars with a Monte Carlo calculation is made. The results indicate that the cascade mechanism is important in these stars, but that present evaporation theories cannot completely explain the decay of the residual nucleus. Pion and proton stars of almost the same total excitation have quite different characteristics. (auth)

4414

MASS DETERMINATION IN PHOTOGRAPHIC PLATES BY MEANS OF PHOTOMETRIC MEASUREMENTS OF IONIZATION. Claude Mabboux and Daniel Morellet. Compt. rend. 238, 1793-5(1954) May 3. (In French)

The photographic measurement of the ionization along a particle track as a function of its path length can be used for the determination of the mass of the particle. The apparatus used, the principle of measurement, the method of measurement, and the errors in the technique are described. (J.S.R.)

4415

A NEW MASS SPECTROGRAPHIC DETERMINATION OF H^1, D^2, He^4, C^{12}, and N^{14}. J. Mattauch and R. Bieri (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 9a, 303-23(1954) Apr. (In German)

The masses of H^1, D^2, He^4, C^{12}, and N^{14} were determined by the mass spectrographic doublet method with an accuracy of 0.3 to 0.5 ppm. The evaluation was made with the help of dispersion lines of known mass of equal absorption. The dependence of the dispersion coefficient on the magnetic field strength was determined. From the very good agreement of the measurements of a group of seven independent doublets, the mass excess was calculated by the Gauss compensation method and the following values, expressed in (m amu ± μ amu), were obtained: (H^1-1) = (8.1459 ± 0.5), (D^2-2) = (14.7444 ± 0.9), (He^4-4) = (3.8797 ± 1.6) and $(C^{12}-12)$ = (3.8231 ± 3.3). The mass excess of N^{14} was found by measurement of other doublets to be $(N^{14}-14)$ = (7.5150 ± 4.9). Measurements, which will also control these values, show an error from an as yet unidentified source of error. From these mass excesses and with the increase of the binding energy of deuterons, the neutron mass, the binding energies of the nuclei He^4, C^{12}, N^{14}, and O^{16}, and other data of interest to nuclear physics was calculated. (tr-auth)

NUCLEAR REACTORS

4416

Livermore Research Lab., Calif. Research and Development Co.

RADIOLOGICAL MONITORING DURING A WATER BOILER-TYPE REACTOR STARTUP. R. A. Sulit. March 1954. 38p. Contract AT-(11-1)-74. (LRL-99)

The health physics phase of the startup of a water boiler-type reactor is described. The personnel control procedures, radiation survey instruments, and monitoring results during the critical experiment and power tests are enumerated. Graphs and charts are included showing the relation of maximum permissible levels of gamma, fast, and slow neutron radiation to the operating power level. (auth)

NUCLEAR TRANSFORMATION

4417

Yale Univ.

RESEARCH STUDY OF THEORETICAL NUCLEAR PHYSICS. REPORT NO. 4. NOTE ON NUCLEAR CROSS SECTIONS AT LOW ENERGIES. PERIOD COVERED MAY 19, 1953–DECEMBER 3, 1953. J. L. Johnson and H. M. Jones. 27p. Contract DA-19-059-ORD-1447. (NP-5183)

The note is concerned with estimates of the accuracy of the one-term formula for the energy dependence of the reaction cross section for charged particles. The second term in an expansion of the cross section in powers of the energy is worked out for a one-body model. Comparison with data of Sawyer and Phillips on the bombardment of Li and Be with protons and deuterons shows that the deviations from the one-term formula are of the correct order of magnitude to be accounted for by the second term. This

term was compared with the effect of the 107-kev resonance on the cross section of $H^3(d,n)He^4$. Employing a conservative central-field model, the correction term to the one-body asymptotic form is found to be smaller than the effect of the resonance expected from the Breit-Wigner formula. The function generalization to L > 0 which has been made by Breit is studied, and a table facilitating its use for the calculation of reaction cross sections is given. (auth)

4418

Radiation Lab., Univ. of Calif., Livermore

EXCITATION FUNCTION MEASUREMENTS FOR (d, 2n) REACTIONS WITH Ti^{48}, Cr^{52}, AND Fe^{56}. Warren H. Burgus, George A. Cowan, James W. Hadley, Wilmot Hess, M. Lynn Stevenson, Theodore Shull, and Herbert F. York. Feb. 1954. 37p. Contract W-7405-eng-48. (UCRL-4292)

The excitation functions for the reactions $Ti^{48}(d, 2n)V^{48}$, $Cr^{52}(d, 2n)Mn^{52}$, and $Fe^{56}(d, 2n)Co^{56}$ were measured by the usual stacked-foil method by using the 20-Mev deuteron beam of a 60-in. cyclotron. The energy of the deuterons striking the foils in the target stack was determined during each run by measuring the energy of the deuterons as they left the target. The absolute cross sections for the reactions were determined by chemical separation of the end products of the reactions from the target foils with subsequent absolute beta counting. (auth)

4419

COMPARISON OF NUCLEAR AND GAMMA-RAY ENERGY SCALES. K. W. Jones, R. A. Douglas, M. T. McEllistrem, and H. T. Richards (Univ. of Wisconsin, Madison). Phys. Rev. 94, 947-52(1954) May 15.

Cylindrical and spherical electrostatic analyzers have been used to measure the ratio of the threshold proton energy for the $Li^7(p,n)Be^7$ reaction to the Q of the $Mg^{24}(p,p')Mg^{24*}$ reaction. This ratio was found to be 1.3734 ± 0.0007. The energy of the gamma ray from Mg^{24*} has been compared earlier by Hedgran and Lind to other gamma rays whose energies have been measured absolutely by either the curved crystal spectrometer method (Au^{198}-Caltech) or proton-moment calibrated magnetic field (Co^{60}-Lindstrom et al.). The present data fix the Li(p,n) threshold as 1881.4 ± 1.1 kev in terms of the Caltech value for the Au^{198} gamma, or as 1879.7 ± 1.1 kev in terms of the Lindstrom et al. value for a Co^{60} gamma ray. The former value is in better agreement with currently used nuclear energy scales. (auth)

4420

YIELDS OF FISSION PRODUCTS FROM U^{238} IRRADIATED WITH FISSION SPECTRUM NEUTRONS. R. N. Keller, E. P. Steinberg, and L. E. Glendenin (Argonne National Lab., Lemont, Ill.). Phys. Rev. 94, 969-73(1954) May 15.

A radiochemical investigation of the fission yields of 15 products in the fission of U^{238} is described. The average energy of the neutrons effective in inducing fission is estimated as 2.8 Mev. The familar twin-peaked yield-mass distribution is observed with a peak-to-trough ratio of 200 to 1. A comparison of the fission yield-mass curve for U^{238} with those for other fissile nuclei is made. (auth)

4421

SPALLATION STUDIES OF BISMUTH. W. E. Bennett (Univ. of Chicago, Ill.). Phys. Rev. 94, 997-9(1954) May 15.

A study of the relative yields of Po, Bi, Pb, and Tl isotopes produced in the bombardment of bismuth with high-energy protons has been carried out. It has been shown that the emission of neutrons is favored over the emission of charged particles in the formation of spallation products in this region. (auth)

4422

MEASUREMENTS OF THE DECAY OF Ti^{51}, Al^{28}, Mg^{27}, AND Cl^{34} WITH A SCINTILLATION SPECTROMETER. Th. Mayer-Kuckuk (Max-Planck-Institut für medizinische Forschung, Heidelburg, Germany). Z. Naturforsch. 9a, 338-46(1954) Apr. (In German)

An arrangement of two scintillation counters is described, which was used for obtaining the γ spectrum and making β-γ and γ-γ coincidence measurements. The isotopes Ti^{51}, Al^{28}, Mg^{27}, and Cl^{34} were investigated. In the decay of Ti^{51} a ray of 0.32 Mev was found. A suspected γ ray at 2.4 Mev could not be found in Al^{28} decay. A new decay scheme for Mg^{27} was suggested with a 1.6 and a 1.7 Mev component in coincidence with a 1.0- and 0.84-Mev γ ray, respectively. The existence of a short isomeric state in the decay of Cl^{34} was verified. (tr-auth)

PARTICLE ACCELERATORS

4423

Atomic Energy Research Establishment, Harwell, Berks (England)

STABILITY OF PERTURBED ORBITS IN THE SYNCHROTRON. J. S. Bell. Mar. 1954. 21p. (AERE-T/R-1383)

A general account is given of the first-order stability of, and of the effects of pertubations on, periodic orbits in static fields. The application is to the strong-focused synchrotron. The object is to develop the general theoretical arguments by which the basic qualitative conclusions can be drawn before specific calculations are made. The arguments available hitherto are augmented by the introduction of certain homogeneous quadratic functions (of the variables describing small deviations from the closed orbit) which are constants of the motion; their properties allow the classification, in a very general way, of the conditions under which "twist" perturbations do and do not induce instability. (auth)

4424

Microwave Lab., Stanford Univ.

DEVELOPMENT OF 6 MEV LINEAR ACCELERATOR FOR MEDICAL AND RADIOGRAPHICAL APPLICATIONS. STATUS REPORT [FOR] MARCH 1–MAY 31, 1952. 10p. Contract Nonr-225(06) (ML-166)

Basic design parameters are presented for an electron accelerator of approximately 6 Mev for use as an industrial or medical tool. (C.H.)

4425

Microwave Lab., Stanford Univ.

DEVELOPMENT OF 6 MEV LINEAR ACCELERATOR FOR MEDICAL AND RADIOGRAPHICAL APPLICATIONS. STATUS REPORT [FOR] JUNE 1–AUGUST 31, 1952. 5p. Contract Nonr-225(06) (ML-167)

Progress is reported in the construction and testing of components for a 6 Mev accelerator. Some design data are included. (cf. ML-166.) (C.H.)

4426

California Univ., Los Angeles

ON THE SUPPRESSION OF COHERENT RADIATION BY ELECTRONS IN A SYNCHROTRON. John S. Nodvick and David S. Saxon. May 1954. 18p. Contract N6onr-275-Task Order 4, Technical Report No. 21. (NP-5197)

Approximate expressions are obtained for the coherent radiation loss by electrons in a synchrotron in the presence of finite parallel plate metallic shields, such as the pole faces of the magnet. The results would seem to provide a useful interpolation between the two simple limiting cases of shielding by infinite plates and no shielding at all. (auth)

4427

ON THE CONVERGENCE OF THE BEAM IN A STATIONARY WAVE ACCELERATOR. Jacques Pottier. Compt. rend. 238, 1795-7(1954) May 3. (In French)

The second order effects caused by alternating regions of focusing and defocusing in a certain type of linear

accelerator can be used to verify simultaneously the conditions of convergence and of phase stability in ionic beams. (tr-auth)

4428

HYDROGEN SUPPLY AND BEAM FOCUSING FOR ELECTROSTATIC GENERATOR. C. J. Strumski, D. I. Cooper, D. H. Frisch, and R. L. Zimmerman (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 25, 514(1954) May.

Two devices which have proved helpful in designing a small Van de Graaff generator are described. The first is a supply of H_2 for the r-f ion source, and the second is an alternating-gradient electrostatic lens on the separated mass-one beam. (L.T.W.)

4429

NEW DEUTERIUM SUPPLY FOR CYCLOTRON ION SOURCES. J. J. Burgerjon (National Physical Lab., P. O. Box 395, Pretoria, South Africa). Rev. Sci. Instr. 25, 522-3(1954) May

An electrolysis cell and vacuum leak are described for supplying D_2 to the ion source of a cyclotron. (L.T.W.)

4430

THE ACCELERATION OF HEAVY IONS IN A FIXED-FREQUENCY CYCLOTRON. D. Walker, J. H. Fremlin, W. T. Link, and K. G. Stephens (Univ. of Birmingham, England). Brit. J. Appl. Phys. 5, 157-64(1954) May.

A study was made of the acceleration of the ions $^{9}Be^{4+}$, $^{12}C^{5+}$, $^{13}C^{5+}$, $^{13}C^{6+}$, $^{14}N^{6+}$, $^{15}N^{6+}$, $^{16}O^{6+}$, and $^{20}Ne^{9+}$ in a 60 in. fixed-frequency cyclotron. Since the momentum which can be imparted to an ion in a given cyclotron magnet is proportional to the charge carried by the ion, one of the chief problems in accelerating heavy ions to high energies is that of obtaining highly charged ions. Of particular interest are ions with a final charge which is a multiple of 3, as ions with one-third of the final charge can be extracted from the ion source and accelerated at closely the same value of magnetic flux density as the final ion. These ions with one-third of the final charge have a frequency of revolution which is one-third that of the final ions. This preliminary "third harmonic" acceleration of the ions with a low charge gives them such an energy that collisions with gas atoms in the cyclotron tank can strip the ions to the final state of charge desired. This mechanism of acceleration leads to a continuous energy distribution of the final ions of high charge. The beam current of high energy ions can be increased by increasing the pressure of gas in the cyclotron tank to increase the probability of stripping. (auth)

RADIATION ABSORPTION AND SCATTERING

4431

Hanford Works

GAMMA-RAY ABSORPTION COEFFICIENTS AT 6.13 MEV. R. S. Paul. Mar. 12, 1954. 21p. Contract W-31-109-Eng-52. (HW-31123)

Narrow-beam geometry attenuation measurements have been made with the 6.13-Mev γ rays from N^{16} using a NaI scintillation spectrometer detector. The measured absorption coefficients in cm^2/gm are: 0.0244 (C), 0.0264 (Al), 0.0309 (Cu), 0.0359 (Cd), 0.0359 (Sn), 0.0436 (Pb), 0.0459 (U), 0.0284 (H_2O), 0.0350 (NaI). The statistical standard deviations range from 0.2% to 0.4%. These values are in good agreement with those for the particular absorbers which have previously been experimentally determined. "Experimental" pair-production cross sections are derived from the data and compared with the calculated values from the Born approximation to the Bethe-Heitler theory. A discrepancy of 7 to 8% is observed for high atomic number elements (Pb and U). (auth)

4432

ON THE THEORY OF X-RAY SMALL-ANGLE SCATTERING. Yin-Yuan Li and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 94, 866-71(1954) May 15.

It is pointed out that a Fourier inversion of the intensity distribution of x-ray scattering, taking the small-angle scattering alone, gives the electron density function of the continuum approximation. The procedure of including only the central scattering is practicable, when none of the peaks of the lattice diffraction occurs at such a small angle that their scattered intensity overlaps the central scattering. A general discussion of the choice of the sign of the phase factor in the Fourier transformation and of its experimental consequences is given. The analysis is applied to scattering in a supersaturated Al-Ag alloy and to a discussion of some of the approximate formulas used in fitting experimental data. When the electron density function of the scattering center has an odd symmetry with respect to one of the coordinate variables, conclusions can be drawn about the scattered intensity distribution without actually knowing the density function. The most interesting case of an odd symmetry is the edge dislocation. An experiment is suggested to reveal the pileup of dislocations as well as the aggregation of vacancies along the slip plane of a metal crystal deformed by a pure shear stress. (auth)

4433

GAMMA RAYS FROM THE INELASTIC SCATTERING OF 14-MEV NEUTRONS IN C^{12} AND O^{16}. L. C. Thompson and J. R. Risser (Rice Inst., Houston, Texas). Phys. Rev. 94, 941-3(1954) May 15.

A NaI scintillation spectrometer has been used to study the gamma rays produced by the inelastic scattering of 14-Mev neutrons in carbon and oxygen. The scattering material was placed around the neutron source with the gamma-ray detector outside the scatterer. A gamma ray from the 4.43-Mev level in C^{12} was obtained with a cross section of about 0.3 barn. Gamma rays from the known level at 6.13 Mev and levels close to 7 Mev were obtained from O^{16} with a total cross section of about 0.2 barn. (auth)

4434

GAMMA RAYS FROM $N^{15}(p,\alpha\gamma)C^{12}$ AND $N^{15}(p,\gamma)O^{16}$. Alfred A. Kraus, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 94, 975-6(1954) May 15.

A new resonance in the reaction $N^{15}(p,\alpha\gamma)C^{12}$ giving the 4.43-Mev γ ray from the first excited state of C^{12} has been found at a proton energy of 1.64 ± 0.03 Mev. The angular distribution of the γ rays indicates that the resonant state in the compound nucleus O^{16} at an excitation energy of 13.65 Mev has spin and parity equal to 1^+ or 2^-. The resonance at 1.05-Mev proton energy has been reinvestigated. At this resonance the capture γ rays from the reaction $N^{15}(p,\gamma)O^{16}$ are found to be isotropic, which indicates that this 13.09-Mev level of O^{16} has spin equal to 1. A search was made for capture γ rays at the 0.340-Mev resonance of $N^{15}(p,\alpha)C^{12}$ but there were less than 1 percent of the number at the 1.05-Mev resonance. Therefore, it seems that these two levels do not have identical spin, parity, and isotopic spin values. (auth)

4435

HIGH-ENERGY PHOTOPROTON PRODUCTION BY 325-MEV BREMSSTRAHLUNG RADIATION. B. T. Feld, R. D. Godbole, A. Odian, F. Scherb, P. C. Stein, and A. Wattenberg (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 94, 1000-10(1954) May 15.

Photoprotons with energies above 120 Mev have been studied at the M.I.T. synchrotron. Angular distributions of protons with 126 Mev, 169 Mev, and 203 Mev were obtained in the angular range from 20° to 160° from both beryllium

and carbon targets. These observations showed that the protons in a Be and in a C nucleus behave identically in high energy photoproton production. The energy distribution of photoprotons from carbon at 30° was investigated in particular detail. A break is observed in the energy distribution which appears to be in accordance with Levinger's "quasi-deuteron model." Absolute values for the differential and total cross sections were obtained. A detailed analysis of existing data is given which raises the possibility that the agreement with the "quasi-deuteron model" may be fortuitous. (auth)

4436

POLARIZATION OF NUCLEONS ELASTICALLY SCATTERED FROM NUCLEI. G. A. Snow, R. M. Sternheimer, and C. N. Yang (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 1073-4(1954) May 15.

A theory for the polarization of elastically scattered nucleons is developed in terms of a nuclear spin-orbit interaction potential. Serber's transparent nuclear model is used by adding a proton orbital and spin angular momentum term to the constant nuclear complex potential over a sphere. (K.S.)

RADIATION EFFECTS

4437

EFFECT OF NEUTRON BOMBARDMENT ON A ZINC SULFIDE PHOSPHOR. Alan W. Smith and John Turkevich (Princeton Univ., N. J.). Phys. Rev. 94, 857-65(1954) May 15.

An investigation has been made of the effect of neutron irradiation on the following properties of a copper-activated zinc sulfide phosphor: luminescence efficiency under ultraviolet and x-ray excitation, infrared quenching of luminescence, temperature dependence of luminescence efficiency, thermoluminescence, rise time of luminescence, decay of luminescence, and dependence of the rise time of luminescence on the previous history of the sample. In addition, the analogous changes in the dielectric constant of the phosphor on illumination were measured for samples damaged to a varying degree by neutrons. It was shown that neutron damage can be removed by annealing at high temperature. (auth)

4438

THE KINETICS OF THE COLORATION AND LUMINESCENCE OF VITREOUS SILICA INDUCED BY IRRADIATION WITH X- AND γ-RAYS, WITH OBSERVATIONS ON RELATED PHENOMENA. F. S. Dainton and J. Rowbottom (Univ. of Leeds, England). Trans. Faraday Soc. 50, 480-93(1954) May.

Methods are described for determining the kinetics of color center formation induced in vitreous quartz by irradiation with x and γ rays, the optical bleaching of these centers, and the slow radiophosphorescence. Observations on the x-ray-induced fluorescence and the emission spectra of the radioluminescence are also recorded. The color centers involved are, in some respects, similar to those in irradiated alkali halide crystals. The long-lived phosphorescence, however, appears to be impurity activated. These results are discussed in the light of existing theories. (auth)

RADIOACTIVITY

4439

ON THE THEORY OF MIGDAL. R. R. Roy and M. L. Goes (Univ. Libre de Bruxelles, Belgium). Bull. Classe Sci. Acad. 40, 143-9(1954) Feb. (In French)

The probability of ionization during the α emission of Po^{210} was calculated according to the theory of Migdal and compared with experimental results. The general expressions of the energy distribution of electrons are given. A method which allows the separation of the Migdal electrons from the internal conversion electrons is indicated. (tr-auth)

4440

ON THE FREE PATH OF NEUTRINOS. F. G. Houtermans and W. Thirring (Physikalisches Institut der Universität, Bern, Switzerland). Helv. Phys. Acta 27, 81-8(1954) May 1. (In German).

The free path of neutrinos on the sun is theoretically derived and compared with experimental values. (J.S.R.)

4441

RADIATIONAL K-CAPTURE FOR FORBIDDEN TRANSITIONS. V. V. Turovtsev and I. S. Shapiro (Moscow State Univ. im. M. V. Lomonsova, Russia). Doklady Akad. Nauk S.S.S.R. 95, 777-9(1954) Apr. 1. (In Russian).

The transitions of the first degree of forbiddenness are presented for the vectorial and tensorial variant theory. The form of the γ spectrum caused by K capture in forbidden transitions basically does not change. (J.S.R.)

4442

ANGULAR CORRELATIONS BETWEEN K-CONVERSION ELECTRONS. E. Breitenberger (Cavendish Lab., Cambridge, England). Nature 173, 737-8(1954) Apr. 17.

Extremely thin sources and two scintillation spectrometers in conjunction with single-channel kicksorters were used to investigate the correlations between the K-conversion electrons from the two-step isomeric transitions in Br^{80} and Hg^{197}. Residual scattering effects in the sources were brought under control by using a randomized block method for taking observations. Results are described briefly. (A.G.W.)

4443

THE ENERGIES OF NATURAL ALPHA PARTICLES. G. H. Briggs (Commonwealth Scientific and Industrial Research Organization, Sydney, Australia). Revs. Mod. Phys. 26, 1-6(1954) Jan.

Recalculated values of the energies of natural alpha particles which have been measured precisely by deflection methods are given. The results are based on the new values for the Faraday and the mass of the He^4 atom, a revised value for the author's absolute determination of the main group of Po^{214}, and weighted mean values for the main groups of Bi^{212}, Po^{212}, and Po^{210}. (auth)

4444

THE TOTAL DISINTEGRATION ENERGY OF Al^{28} AND Al^{29} NUCLIDES AND THE MAGIC NUMBER 14. Maurice E. Nahmias. Compt. rend. 238, 1875-6(1954) May 10. (In French)

The disintegration energies of Al^{28} and Al^{29} were measured as $Q = 4.58 \pm 0.15$ and $Q = 3.97 \pm 0.15$ Mev, respectively. The mass of the two isotopes, on the basis of the mass of Si^{28} and Si^{29}, are $Al^{28} = 27.99074 \pm 0.00020$ and $Al^{29} = 28.99010 \pm 0.00020$. The mass of P^{29} is calculated to be 28.99117 ± 0.00020. (J.S.R.)

4445

A PRECISE MOMENTUM MEASUREMENT OF THE F LINE OF THORIUM B. D. I. Meyer and F. H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 94, 927-30(1954) May 15.

The momentum of the internal conversion electrons of the F line of Pb^{212} has been compared with the momentum of electrons accelerated through a known potential difference. The comparison was made by means of an iron-free high-resolution solenoidal magnetic field beta-ray spectrometer.

The value obtained for the F line is 1388.56 ± 0.21 gauss-cm. Other useful calibration lines following the decay of Pb^{212} have also been measured by comparison with the F line. (auth)

4446

EFFECT OF ATOMIC ELECTRON SCREENING ON THE SHAPE OF FORBIDDEN BETA SPECTRA. R. H. Good, Jr. (Pennsylvania State Univ., State College). Phys. Rev. 94, 931-3(1954) May 15.

In Fermi's theory of beta decay, the influence of the atomic electrons on the shape of the spectra is often disregarded since the influence is small except at low energies. However, there is some interest in knowing exactly how small it is. This paper gives an approximate calculation of the screening effect, both for allowed and for forbidden spectra. The Thomas-Fermi model for the atomic electrons and WKB approximations for the wave functions of the emitted particles are used. The results for the allowed spectra agree with those of Rose and Longmire and Brown. The calculations for the forbidden spectra lead to a simple rule for finding the screening effect in any specific case. (auth)

4447

NEUTRON-DEFICIENT ACTIVITIES OF HOLMIUM. Thomas H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 94, 945-6(1954) May 15.

Proton bombardment of pure oxides of Dy, Ho, and Er has served to clear up some uncertainties concerning neutron-deficient activities of Ho. Two previously reported activities, 5.2 day and 65 day, were not found, and reassignment of the 5.0-hour activity to a mass of 162 is made. The gamma-ray spectrum of the 5.0-hour activity shows it to decay by electron capture with gamma energies of 0.19, 0.71, and 0.95 Mev. 41-minute Ho^{164} is shown to decay by electron capture and by β^- emission. (auth)

4448

RADIATIONS OF 53-MIN I^{134} AND 86-SEC I^{136}. Michael McKeown and Seymour Katcoff (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 965-7(1954) May 15.

The radiations from 53-min I^{134} and 86-sec I^{136} were examined with a scintillation spectrometer and compared with known radiations. The former was found to emit beta rays of 1.5 ± 0.1 Mev and 2.5 ± 0.2 Mev maximum energy, and γ rays of the following energies: 0.86 ± 0.01 Mev, 1.10 ± 0.03 Mev, and 1.78 ± 0.05 Mev. Coincidence measurements showed that the 2.5-Mev β rays were followed by the 0.86-Mev γ rays and that the first excited level in Xe^{134} is very likely at 0.86 Mev as predicted by the systematics of even-even nuclei. There is some evidence for two additional weak γ rays at 120 kev and 200 kev. The I^{136} was found to decay by emission of a β-ray branch of 6.3 ± 0.3 Mev maximum energy leading to the ground state of Xe^{136}, a 5.0 ± 0.3 Mev β-ray branch followed by 1.38 ± 0.05 Mev γ rays, and a 3.7 ± 0.2 Mev β-ray branch followed by 2.9 ± 0.2 Mev γ rays. A possible disintegration scheme is proposed. The first excited state at 1.38 Mev corresponds to that expected for the 82-neutron closed-shell nucleus, Xe^{136}. (auth)

4449

YTTERBIUM-167. Thomas H. Handley and Elmer L. Olson (Oak Ridge National Lab., Tenn.) Phys. Rev. 94, 968-9 (1954) May 15.

Proton bombardment of pure Tm_2O_3, followed by ion-exchange separations, has yielded an activity with an 18.5-minute half life. Determination of the excitation function and identification of the daughter Tm^{167} assigns the activity to Yb^{167}. A gamma-ray spectrum shows it to decay by electron capture with a 0.118 Mev and possibly other gamma rays. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4450

TERM SPLITTING IN THE ABSORPTION SPECTRA OF Er AND Tm IN COMPLEXES. L. Holleck and D. Eckardt (Univ. of Hamburg, Germany). Z. Naturforsch. 9a, 347-8(1954) Apr. (In German)

In the term splitting in the absorption spectra of complex solutions of Er and Tm it was shown that Er behaves as Nd and Tm as Pr with respect to their susceptibility to internal electric fields. (tr-auth)

SHIELDING

4451

Oak Ridge National Lab.

BORAL: A NEW THERMAL NEUTRON SHIELD. V. L. McKinney and Theodore Rockwell, III. [1949]. Decl. June 16, 1953. (ORNL-242). SUPPLEMENT 1. A. S. Kitzes and W. Q. Hullings. July 3, 1951. Decl. Dec. 4, 1952. (ORNL-981; AECD-3476). Issued as a combined report May 1954. 40p. Contract W-7405-eng-26. (AECD-3625)

Techniques for making large sheets of B_4C and Al complex are described. Data on physical properties and a method for measuring thermal conductivities are included. Applications of boral for the absorption of thermal neutrons without production of hard γ radiation are discussed. (C.H.)

4452

ON RADIATION-SHIELDING SUBSTANCES OF HIGH ABSORPTION. K. G. Zimmer. Translated from Fortschr. Gebiete Rontgenstrahlen 71, 143-4(1949). 3p. (AERE-Trans-11/3/5/171; AEC-tr-1106)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 4-3823.

SPECTROSCOPY

4453

[Los Alamos Scientific Lab.]

ELECTRON IMPACT BROADENING OF SPECTRAL LINES (thesis). Bennett Kivel. 1954. 88p. Contract [W-7405-eng-36]. (AECU-2874)

A quantum mechanical formalism for treating pressure broadening by electron impacts is developed and applied. In particular, the large region of high temperatures and low densities where electron effects are minor is delimited. With diminution of electron temperature and increased density first order corrections to the natural line are found. Here two perturbations are distinguished: 1) change in electron scattering on atomic transition and 2) polarization of the atom. Having developed methods for these regions of small electron effects, application is made to the hydrogen-like 2p to 1s transition. By inclusion of a second excited state, namely 2s, polarization is studied. Some properties of matrix elements involving the form factor which are familiar in scattering theory are studied in detail. Larger broadening effects are considered. An experiment suitable for verification of this electron collision broadening theory is proposed. (auth)

4454

THE CONSTRUCTION OF A COMBINED SOURCES UNIT FOR EMISSION SPECTROGRAPHY. R. G. Stone and H. L. Bolton (Dept. of Government Chemist, London, England). J. Sci. Instr. 31, 175-8(1954) May.

The construction of a unit is described which contains the circuits of the following spectrographic sources: two intermittent a-c arcs, one pulsed d-c arc, one constant current d-c arc, and a condensed spark. A conventional d-c arc operated from a-c mains supply is also included. Oscilloscope presentation of potential and current pulses across the analytical gap is supplied by three cathode-ray tubes. (auth)

THEORETICAL PHYSICS

4455

Institute of Rate Processes, Univ. of Utah

THE WAVE MECHANICAL PROBLEM OF THREE HYDROGEN ATOMS. TECHNICAL REPORT NO. 4. SOME QUANTUM MECHANICAL INTEGRALS. 3. SOME ELEMENTARY THREE PARAMETER INTEGRALS. (STUDIES IN APPLIED MATHEMATICS, NO. 14). C. J. Thorne, R. S. Barker, and H. Eyring. Mar. 1, 1954. 308p. Contract DA-04-495-ORD-436. (NP-5176)

An extensive table of integral solutions arising from a wave-mechanical formulation of the neutral triatomic molecule is presented. Enough decimal places were calculated to extend the evaluation to 8 significant figures. (K.S.)

4456

THE CONNEXION BETWEEN THE THEORY OF REGULARIZATION AND THE THEORY OF PARTICLES WITH ARBITRARY SPIN. Yu. A. Yappa. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 86, 51-4(1952). 9p. (TT-428)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-3973.

4457

THE MESON THEORY OF NUCLEAR FORCES. II. HIGH ENERGY NUCLEON-NUCLEON SCATTERING. Saburo Fujii, Junji Iwadare, Shoichiro Otsuki (Kyoto Univ., Japan), and Mitsuo Taketani (Rikkyo Univ., Japan), Smio Tani, and Wataro Watari. Progr. Theoret. Phys. (Japan) 11, 11-19 (1954) Jan.

Using the potentials derived from ps(pv) meson theory of the second and fourth order, neutron-proton and proton-proton scattering at 40 and 90 Mev in the laboratory system are examined. Calculation is performed by numerical integrations. The characteristic features of high-energy nucleon-nucleon scattering are fairly well explained by the pseudoscalar meson potential. (auth)

4458

NUCLEON SCATTERING BY A POTENTIAL. Masahiko Matsumoto and Wataro Watari (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 63-79(1954) Jan.

Scattering of a nucleon by a central potential is discussed. The potential consists of a sequence of square wells. Relations between the phase shift of the partial wave and the potential shape are extensively examined for the incident energy lower than 300 Mev in the laboratory system. The S, P, D, F, and G partial waves are taken into account. The results are summarized in the form of graphs. (auth)

4459

NOTE ON THE SECOND KIND INTERACTION. Susumu Okubo (Tokyo Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 80-94(1954) Jan.

Examples which should not be treated by the perturbation are given, and it is shown that there exist some second-kind interactions which become first kinds if the uses of the perturbation are avoided. Especially, the pseudoscalar theory with the vector coupling after the Dyson transformation belongs to this, although it is proved only for the vanishing meson mass. The Green functions in the scalar meson theory with the vector coupling are obtained exactly. (auth)

4460

FERMI'S THEORY OF THE GENERATION OF PIONS AND THE PARTITION THEORY OF NUMBERS. F. C. Auluck and D. S. Kothari (Univ. of Delhi, India). Progr. Theoret. Phys. (Japan) 11, 120-1(1954) Jan.

Results which have been obtained from the partition theory of numbers are applied to the problem of pion production in high-energy nucleon collisions. (L.M.T.)

4461

THE FORMAL THEORY OF ERROR ESTIMATION OF REARRANGEMENT COLLISIONS. Tatuya Sasakawa (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 121-3 (1954) Jan.

A procedure similar to that employed by Chew and Goldberger for multiple scattering is used to show how the error of rearrangement collision can be expressed as the sum of errors associated with the entrance channel plus ones associated with the outgoing channel plus the wave function used. (L.M.T.)

4462

NOTE ON MESON-NUCLEON INTERACTION. Shigeo Minami. (Osaka Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 123-4(1954) Jan.

The problem of angular momentum in meson-nucleon scattering and photomeson production is treated. (L.M.T.)

4463

ON THE QUANTUM THEORY OF NONRENORMALIZED WAVE EQUATIONS. W. Heisenberg (Max-Planck-Institut für Physik, Göttingen, Germany). Z. Naturforsch. 9a, 292-303(1954) Apr. (In German)

A method for the quantization of nonlinear wave equations was applied to a special problem. After preliminary remarks concerning the Hilbert space of systems, the "velocity functions" of nonlinear wave equations were studied. The relationship of these functions to the permutation functions was discussed, and the relation to the regularization method of Pauli and Villars was indicated. The mass of the lightest spinor particles was approximated, and the eigenvalue equation for Bose particles was given. The conservation principle was discussed. The convergence of the approximation methods was shown, and qualitative expressions of the reciprocal action of the elementary particles were described. (tr-auth)

4464

ON THE FIELD THEORY DESCRIPTION OF SOLID BODIES. Hermann Kümmel (Univ. of Berlin, Germany). Z. Naturforsch 9a, 331-5(1954) Apr. (In German)

The Feynmann-Dyson graph method was transferred to the quantum field theory of solid bodies. The transference was made by considering the electrons without resonance quanta-reciprocal interaction as free and by use of the Bloch approximation. The appropriate Bethe-Salpeter equation for the interaction of two electrons was investigated. It is shown that from the "attraction" in the impulse space the possibility of the existence of a bound state cannot be established as the homogeneous Bethe-Salpeter equation offers no solution. (tr-auth)

4465

A NOTE CONCERNING THE QUANTIZATION OF SPINOR FIELDS. J. M. Jauch (State Univ. of Iowa, Iowa City). Helv. Phys. Acta 27, 89-98(1954) May 1. (In English)

It is shown that the anticommutation rules between ψ and $\bar{\psi}$ determine to a large extent those between ψ at different space-time points. The remaining freedom can be characterized by a real parameter ρ, $0 \leq \rho \leq 1$. The special case $\rho = 0$ corresponds to the usual method of quantization. The cases $\rho \neq 0$ can only be used for the description of particles with no electromagnetic interaction. The special case $\rho = 1$ represents the Majorana field. There is no physical principle or experimental result known to rule out the cases $\rho \neq 0$. (auth)

4466

ON THE ELIMINATION OF INFINITY IN QUANTUM ELECTRODYNAMICS. L. D. Landau, A. A. Abrikosov, and I. M. Khalatnikov. Doklady Akad. Nauk S.S.S.R. 95, 497-500(1954) Mar. 21. (In Russian).

4467
INVESTIGATION OF THE CONFIGURATIONAL INTERVAL FOR SYSTEMS OF PARTICLES WITH COULOMB INTERACTION. D. N. Zubarev. Doklady Akad. Nauk S.S.S.R. 95, 757-60(1954) Apr. 1. (In Russian)

A method, based on the introduction of "excessive" collective transformations, is presented for the calculation of the configurational intervals for systems with Coulomb interactions. (J.S.R.)

4468
SYSTEMS OF COVARIANT EQUATIONS IN THE THEORY QUANTUM FIELDS. B. L. Ioffe. Doklady Akad. Nauk S.S.S.R. 95, 761-4(1954) Apr. 1. (In Russian)

A definite solution is reached (i.e., without separation according to e^2/hc) for a system of relativistic covariant equations. Although only the case of a nucleon field interacting with a neutral pseudoscalar field is discussed, the method can be applied to quantum electrodynamics or to charged meson fields. (J.S.R.)

4469
ASYMPTOTIC EXPRESSION FOR GREEN'S FUNCTION OF ELECTRONS IN QUANTUM ELECTRODYNAMICS. L. D. Landau, A. A. Abrikosov, and I. M. Khalatnikov. Doklady Akad. Nauk S.S.S.R. 95, 773-6(1954) Apr. 1. (In Russian)

4470
SINGLE-TIME FORMALISMS FROM COVARIANT EQUATIONS. Abraham Klein (Harvard Univ., Cambridge, Mass.). Phys. Rev. 94, 1052-6(1954) May 15.

The main purpose of this paper is to provide a concise general deduction of a result which has previously been reported and applied. The result is a single-time wave equation for a two-nucleon system obtained from the covariant two-body equation by means of an iteration procedure which employs the solution of the latter for an instantaneous interaction. The single-time wave function contains only positive energies. Possible generalizations to include negative-energy components and higher amplitudes are discussed, but none of these is carried out in detail. (auth)

URANIUM AND URANIUM COMPOUNDS

4471
STUDY OF THE VARIATION IN THE EFFECTIVE FISSION CROSS SECTION OF U^{235} IN THE THERMAL AND EPITHERMAL REGION. Pierre Hubert, Georges Vendryes, and Jean-Michel Auclair. Compt. rend. 238, 1873-5(1954) May 10. (In French)

A neutron diffraction spectrometer was used to compare the fission cross section of U to the cross section of the reaction $B^{10}(n,\alpha)Li^7$ as a function of neutron energy. The curve obtained showed that, in the region studied (from 10^{-2} to 3 ev), U^{235} has fission resonances whose average interval is of the order of 1 ev. (tr-auth)